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METAL FINISHING

Shifting Sands of Industry

One of the more significant trends over the past decade has been the growth of a sizeable manufacturing industry on our West Coast. This was a natural result of the steady increase in population in that area, and with it the demand for local goods and services. We in the metal finishing field have watched this development with keen interest, as reports from our coast representative indicated the new finishing facilities and branch supply distribution centers that were being established. If this trend continues, this area will soon be ranked with the New York and Chicago-Detroit areas as an industrial center of the nation.

However, two important factors loom up as being instrumental in reversing this trend. The first revolves around the considerations of de-centralization and dispersal of industrial manufacturing facilities as a part of national defense measures, especially important in these days of long-range bombers and atomic weapons. The second factor is created by the recent Supreme Court ruling affecting the steel industry's basing point system of pricing, which makes it decidedly advantageous for industries using large quantities of steel to locate near the steel-producing areas. Together these two conditions would seem to forecast a forced shifting of industry away from the coastal areas towards a more central location close to the steel production centers. Because of the closely-knit relation between steel consumption and the extent of metal finishing operations, this could have far-reaching effects in our field.

Neglecting the factor of national defense, an opposite trend which would stabilize coastal industry would be the enlarging of steel making facilities in these regions. This possibility, a case of "moving the mountain to Mohammed" seems very unlikely, as the building or expansion of steel mills entails the expenditure of many millions of dollars, and is not looked upon with favor even by the largest producers.

All this seems to add up to a further growth of our already heavily industrialized Middle-West and its far-flung automotive empire. It is felt that the newly established Mid-Western office of Metal Finishing in Chicago will better enable us to keep pace with this growth, and make it possible to present our readers with the advanced technology that such growth always stimulates.

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Fluid Mechanics: Forgotten Factor in Electroplating—Part IV

By Joseph B. Kushner, *Metal Finishing Consultant, New York City*

The final installment of this series, the present article discusses the cathode film, and the relative merits of various methods of solution agitation on the limiting current densities that can be used for electroplating.—ED.

WHEN a liquid moves past a solid surface or vice versa, no matter how turbulent the motion, there is always a thin layer of liquid in close contact with the surface that is moving with viscous flow. This layer cannot be eradicated completely but it can be brought close to the vanishing point.

If the velocity of the fluid past the solid surface is increased then the rubbing action between the stagnant, or slowly moving film, and the rapidly moving body of liquid is such as to thin out the film.

Increasing the density of the fluid will also effect the thickness of the stagnant film, because increasing the rubbing weight will increase the rubbing action between the viscous film and the turbulent body of the liquid. The combination of velocity "U" and density "p" is frequently called the *mass velocity* of the fluid.

The viscosity of the fluid also effects the thickness of the stagnant layer because viscosity is the resistance offered to relative motion between two liquid planes; the lower the resistance to separation, the easier it is to approach the solid surface itself.

Another factor is the shape and nature of the solid surface in contact with the liquid. Viscous Films are always thinner at points and edges; a rough surface will tend to increase the resistance of the solid and the fluid to relative motion between them. The higher this resistance, the thicker will the viscous flow layer tend to become.

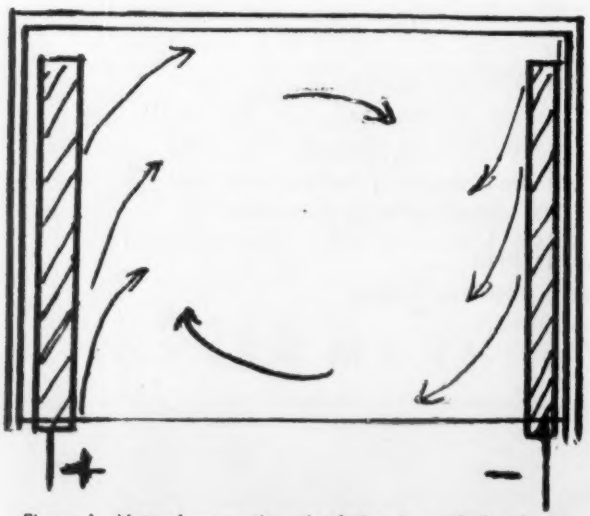


Figure I. Natural convection circulation in a plating bath.

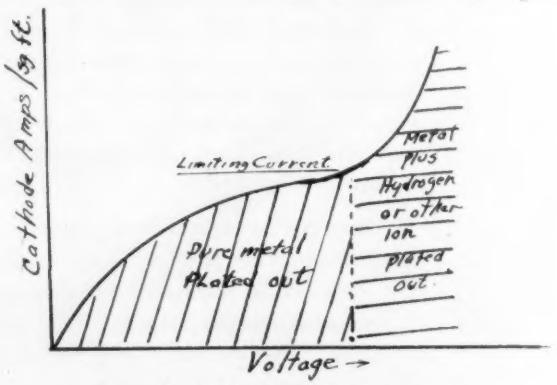


Figure II. Limiting current density curve.

In the flow of liquids in pipes it has been established by experiment that the thickness of the stagnant film varies with the Reynolds Number in the following way:

$$d \propto \frac{1}{Re^{.8}}$$

which is the approximate equivalent of an inverse relationship,

$$d \propto 1/Re \text{ or } d \propto \frac{Z}{DUp}$$

where d is the thickness of the film, Z the viscosity, D the shape factor (in this case the diameter of the pipe), U the velocity of the fluid, and p its density.

When it comes to flow other than in pipes the subject of film thickness becomes extremely involved and complicated, mathematically speaking. There is little literature available and few experiments have been made in this connection. Nevertheless, the same factors previously mentioned, velocity, density, viscosity, shape, and surface roughness will control the film thickness.

The Stagnant Layer and the Cathode Film

The thickness of this stagnant layer is of vital importance in all electroplating operations. The reason

for this can be readily understood from Diagram No. 1.

As the electroplating process begins, at constant current and temperature, metal leaves the anode surface in solution, making the surrounding liquid heavier than that farther from the anode. This surrounding liquid (anolyte) sinks under the influence of gravity. At the cathode, deposition of the heavy metal leaves the surrounding liquid (catholyte) lighter. This liquid rises, and there is established a natural convection, or flow, which stabilizes itself, if there is no outside source of agitation present, in approximately two minutes (According to an experiment by *Brenner*).

The cathode (in which we are primarily interested), has now reached the "steady state" condition. The catholyte is circulating or moving past the cathode at a steady rate and according to the laws of fluid flow, a viscous or stagnant layer of *definite thickness* exists, which thickness is determined by the mass velocity of the catholyte, its viscosity, and the nature and shape of the cathode surface.

Should the current now be increased, metal will come off the anode more rapidly and metal will be deposited at the cathode more rapidly. This in turn induces the formation of a somewhat thinner stagnant film, because the natural convection rate has been

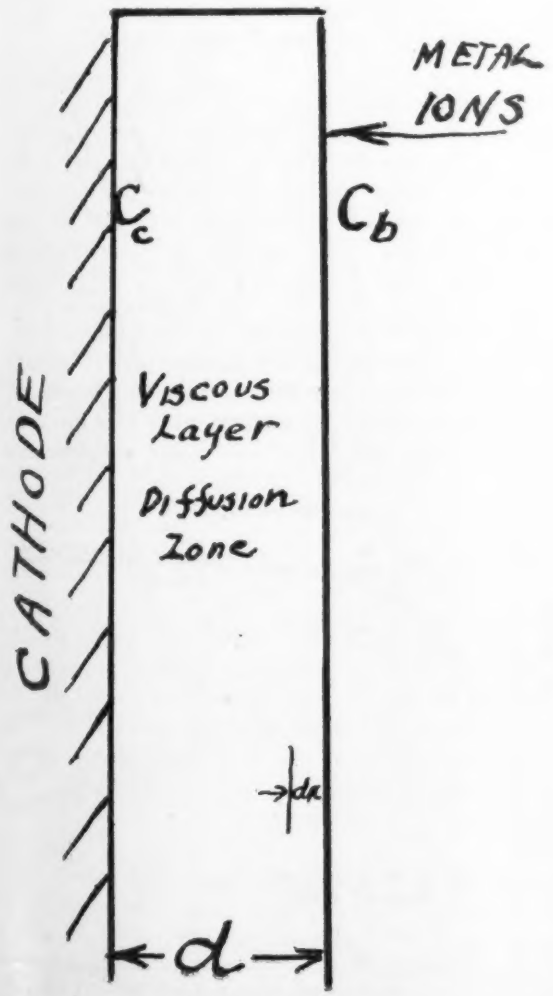


Figure III. Fick's Diffusion Law.

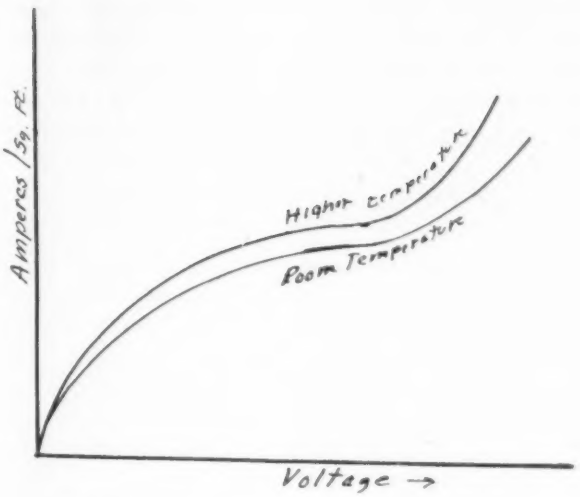


Figure IV. Limiting current density vs. temperature.

increased (the velocity of the catholyte past the cathode is increased). The majority of the metal ions can only travel through this stagnant layer by diffusion, and pretty soon, if the current is raised again, a point is reached where the metal ions cannot arrive at the cathode fast enough. This being so, the efficiency of plating drops below 100% because with insufficient metal ions present in the stagnant layer to satisfy the demand, some other ion present, such as hydrogen, is called upon to make up the difference. At that point we say we have reached the limiting current density for depositing the metal in question, under the given conditions. A curve indicating the meaning of limiting current density is shown in Figure No. II.

Why did this take place? Even though the current was increased, with the temperature constant, the thickness of the stagnant film was not materially decreased, because there is a limit to the velocity a fluid can assume under natural convection. Somewhere, just before the limiting current density was reached, the stagnant cathode film reached its minimum thickness under the conditions of operation, and the increased demand for more metal at the cathode as the current was raised again could not be satisfied, because, while the demand was increased, the traveling time through the stagnant film remained the same, so less metal arrived per unit time and therefore the efficiency dropped.

Mathematically speaking, this can be explained as follows:

The rate at which a substance will diffuse through a thin layer, dx, at a constant temperature, is given by *Fick's Law*:

$$\frac{dG}{dt} = K \frac{dC}{dx}$$

which says, the amount of matter transferred per unit area, per unit time, $\frac{(DG)}{dt}$ is equal to a constant K multiplied by the force causing the transfer (dc, the

concentration difference of the substance at either side of the layer), divided by the resistance to the force, which is the thickness of the layer, dx.

In the case of ions reaching the cathode through the stagnant film, this equation also holds, and assuming the film thickness to be small $\frac{dG}{dt} = K \frac{(C_b - C_c)}{d}$

where C_b is the concentration of the ion in the main body of solution and C_c is the concentration of the ion at the cathode face and d is the thickness of the stagnant film. See Figure III.

When the "steady state" is reached, the rate at which the metal ions are brought to the cathode will be equal to the rate at which they are discharged. For a unit area of the cathode surface the rate at which the ions are discharged is equal to I/nF where I is the current, n the valence of the metal ion in question, and F is the Faraday. The latter two items are constants so we can say:

$$I = K_2 \frac{(C_b - C_c)}{d} + \text{ions brought up by transference.}$$

The term on the extreme right accounts for metal ions brought to the cathode by the process of transference or ion migration, but in the presence of conducting salts, acids or bases) the amount of metal ions brought up this way is so small it can be neglected.

This equation holds only up to the limiting curent density. When d can no longer be reduced by the action of the current itself in causing the natural convection flow of the catholyte, the terms on the right become smaller than I and some other ion already present in the stagnant film has to be discharged to make up for this lack.

If the temperature of the plating bath is raised, the viscosity of the electrolyte is reduced, which permits the natural convection flow to proceed at a faster rate. This being so, the stagnant film is thinned (d is reduced) more, and it becomes possible to plate at a higher current density than before. That is, the limiting current density is raised, as shown in graph, Figure IV. Similarly, if the concentration of the metal ion in the solution is increased, the driving force $(C_b - C_c)$ is increased and it also becomes possible to plate at a higher limiting current density.

The concentration increase is limited by the solubility of the metal salt, and the temperature that can be used is also a fairly limited factor (except when plating under pressure, as pointed out in Part I of this series), so the only other factor that can be manipulated in order to use a higher current density in plating, is the thickness of the film, d, as controlled by fluid velocity, density, viscosity, and the shape and surface nature of the parts being plated.

Agitation in the Plating Bath

Forced convection in the plating bath performs two functions: (1) It corrects thermal and material stratification or non uniformity, and (2) It thins out the viscous cathode film. Material and thermal stratification have already been discussed in Part III of this series so we will confine ourselves to the subject of thinning the cathode film.

If a plot were made of metal ion concentration through the cross section of a plating bath operating under natural convection, the result would be something like that shown in Figure Va. The main body of the solution has the average metal ion concentration whereas near the cathode the concentration drops sharply and near the anode it rises sharply.

Looking at a magnified view of this curve near the cathode Figure Vb, it can be seen that the concentration drop from the main mody of the solution takes place in the stagnant layer of catholyte. The actual thickness d, of the viscous film is the distance from the cathode face to the point where the metal ion concentration is that of the main body of the solution. This distance may be as much as 0.1". For mathematical simplicity, however, the gradient is assumed to be a straight line instead of the curve that it really is. This gradient line is such that the area it includes (as shown in the graph Vb) is equal to the area included by the curve. Accordingly, the film thickness is the distance MN. For even more simplification

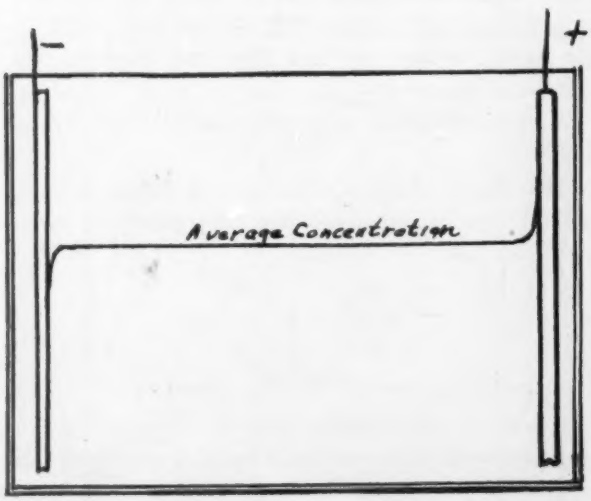


Figure Va. Metal concentration gradient in a plating bath.

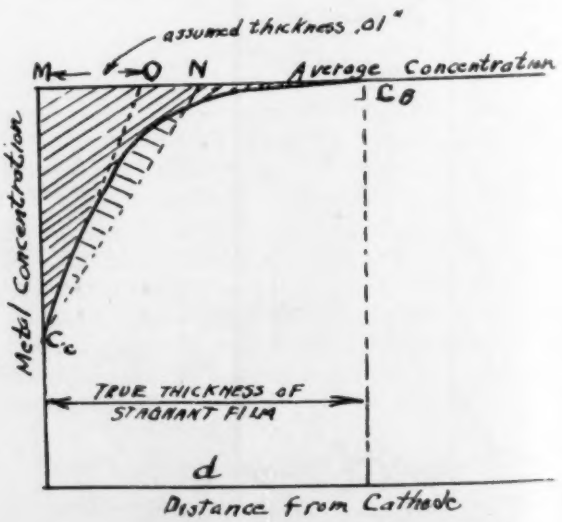


Figure Vb. Metal concentration gradient at cathode.

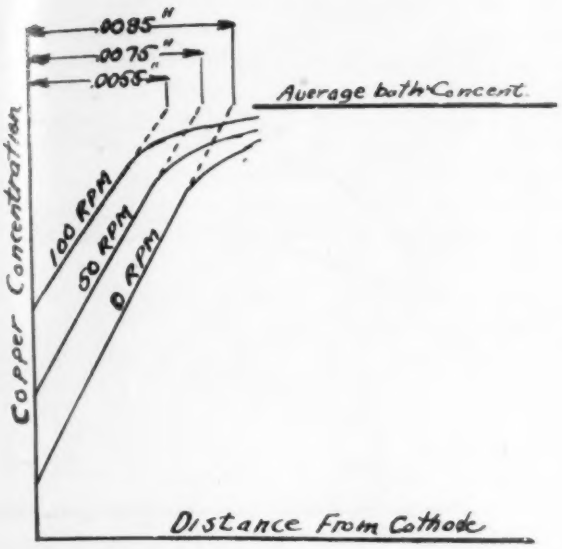


Figure VI. Thinning of cathode film (after Brenner).

the gradient can be assumed to be the projection of the straight line portion of the gradient curve, giving MO as the apparent film thickness.

Brenner, in a strikingly original piece of research work, utilizing the method of rapid freezing of the cathode film, showed that the distance MO is approximately 0.01". This is roughtly one half of the distance .02", calculated for the film thickness, using the limiting current equation previously given. This discrepancy has not been satisfactorily explained.

If the plating solution is now agitated, the catholyte flows in forced convection and the cathode film is thinned out, as can be seen from Figure No. VI. The more turbulent the flow becomes, the thinner does the stagnant film become and the higher are the current densities that can be used.

Turbulence in liquid flow means complete random motion of the liquid particles, in which only the laws of probability hold. In the flow of liquids in pipes, the *Reynolds Number*, which is a non dimensional ratio, can be used as a measure of turbulence. Based on the experiment described in Part III of this series, *Reynolds* found that whether a liquid flow is turbulent or not is determined by the ratio $\frac{DUp}{Z}$.

If D is measured in inches, U in ft. per second, p in lbs. per cubic ft. and Z in centipoises, then for tubulent flow, Re must be greater than 9. The higher the Reynolds Number goes the more random does the particle motion become until a particle of liquid behaves like the famed rider in Leacock's story who mounted his horse and "rode off in all directions at once."

The Reynolds Number, being non dimensional, can be employed outside of pipe flow, as a measure of turbulence. It is even possible that it can be used for determining turbulence in a plating bath, but the great difficulty lies in determining D, the shape factor and U, the velocity past a given point.

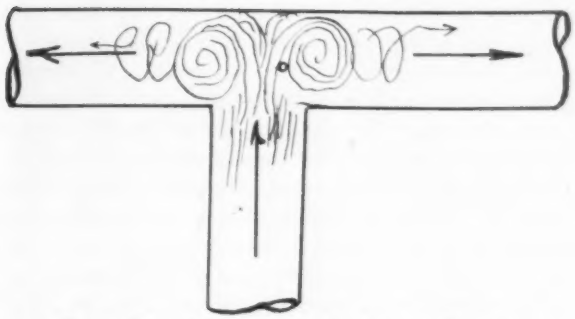


Figure VIIa. Turbulence produced at a pipe tee.

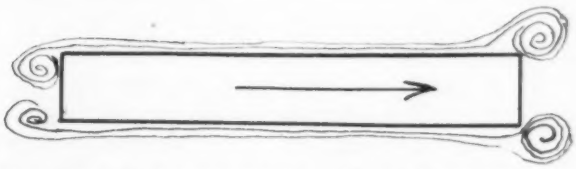


Figure VIIb. Turbulence produced at edges of a flat plate in motion in a plating bath.

Turbulence may be influenced not only by flow velocity but by geometric configuration as well. (See Figure VIIa). Thus in a pipe, a sudden change in direction or expansion can increase the turbulence many times over what it is in the straight pipe. The reasons for this behavior are intimately tied up with the change in shape factor. Where liquid is flowing with a certain amount of turbulence in the center leg of a Tee, the Reynolds Number, $Re = \frac{DUp}{Z}$ can be enormously increased where the liquid suddenly expands into the main pipe because here the shape factor D (the inside diameter of the pipe in this case), is instantaneously increased to a very large value while the velocity has not been materially reduced. Further down stream on either side, the turbulence is diminished by the reduction in shape factor and fluid velocity. In the plating bath, geometric configurations such as to cause sudden change of direction and expansion will likewise cause local turbulence in excess of that of the main body of solution. Figure VIIb.

Reciprocal Cathode Rod Motion as Agitation

A standard method for agitating a plating solution is to use reciprocal cathode rod motion as illustrated in Figure VIII. The cathodes which we are representing as flat plates move backwards and forwards in a steady cycle of usually 6 to 10 times a minute with an overall thrust of from 4" to 12".

How effective is this type of agitation? From the standpoint of stratification, this type of agitation is poor, particularly in a deep bath, because there is not enough circulation from top to bottom. Of course with shapes other than flat plates, there tends to be more top and bottom circulation, but in general it is poor.

From the standpoint of thinning the stagnant cathode film, the method is fair but limited by practical considerations. Work by *Phillips* has shown that it is

possible at room temperature to go from a current density of 36 ASF without cathode rod motion in an acid copper plating bath, to 96 ASF by moving the cathode at a speed of 50 ft. per minute. A speed of 50 ft. per minute is the equivalent of .83 ft. per second. In terms of possible liquid velocities this velocity is puny indeed. For the average type of cathode rod agitation where the cycle is perhaps 6 times a minute and the thrust is 6", the cathode rod speed is only about .1 ft. per second.

It is of interest to consider what the Reynolds Number might be for average agitation of this type. For a flat plate of thickness a and length b, the shape factor would be 4 times the cross sectional area divided by the wetted perimeter or $\frac{4ab}{2a + 2b}$.

In the case of a flat plate of considerable length, a, the thickness, is negligible as compared to the length b, so the shape factor is 2a or two times the thickness. Assuming a thickness of 1/8", then the Reynolds Number (the tank wall is assumed a considerable distance from the plate) is given by

$$Re = \frac{DUp}{Z} = \frac{.25 \times .1 \times 62.4 \times 1.18}{1.2} = 1.2$$

where 1.18 is the specific gravity of the solution and 1.2 is the viscosity of the plating solution in centipoises.

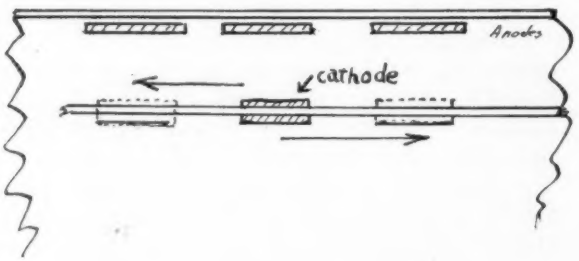


Figure VIII. Reciprocal cathode rod motion.

The value of 1.2 shows there is no turbulence and the cathode film is effected little, if at all. At the speed used by Phillips in his experiment with flat plates, .83 ft./sec., the Reynolds Number is 10, just over the border of turbulent flow. To achieve really turbulent flow with flat plates, the cathode rod would have to move at least 2 ft. per second which would call for 4 cycles a second with a 6" thrust. Reciprocal motion with this velocity is highly impractical in the average plating bath.

Naturally, where the shape is not that of a flat plate, a considerable higher Reynolds Number is possible but the amount of turbulence is not great in any case at the average speed used, and the turbulence is not uniform; that is, various parts of an object are in contact with liquid moving with different degrees of turbulence. This is frequently the cause of certain parts of a moving cathode being burnt while other parts are correctly plated. By simply readjusting the position or angle of the object being plated, in relation to the moving cathode rod, it is possible sometimes to correct this condition. It is also fortunate that in general, where the current density is highest at points and edges, the degree of turbulence will also be highest. This helps keep burning due to exceeding the limiting current density at a minimum.

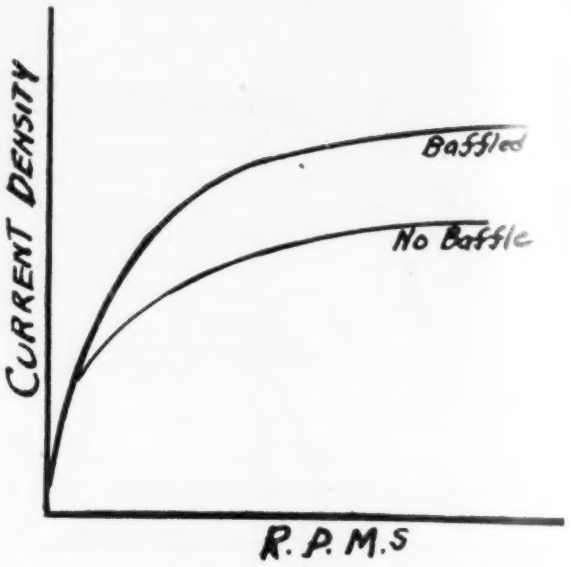


Figure IX. Effect of baffling on Limiting Current Density-Rotary Agitation.

There is also one more point to be considered in connection with agitation of this type. While the leading edge of a cathode is always moving into fresh solution, the trailing edge is always moving into stale or depleted solution when moving in one direction. With the motion reciprocal, then the center of the object suffers this passage through barren solution. This further limits the use of reciprocating cathode rod motion for very high current density plating.

Propeller Type Agitation

Sometimes in electroplating practice use is made of propeller agitation. Because propellers vary in their characteristics and the shape and contour of the tank come into play, it is difficult to evaluate this type of agitation. In general, however, it is probably less effective (with the exception of certain special cases) than cathode rod agitation, because while the propeller blade may be rotating at 400 rpm, the main body of the solution is circulating at a far slower rate. The rate

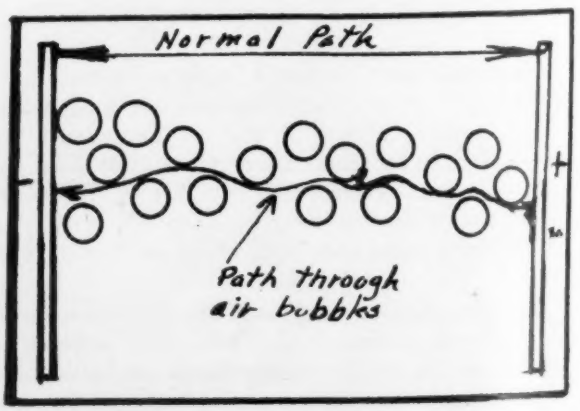


Figure X. Effect of air agitation on increasing resistance of plating bath.

of motion varies with the distance from the propeller, which leads to varying degrees of turbulence on different parts of the cathode, with resulting non-uniformity of plating. Furthermore, there is a tendency for the formation of nodes (points of little motion), as anyone who has ever experimented with propeller agitation knows. In the literature mention is made of such effects by *Graham* who describes an experimental bright nickel plate which had a dull spot just opposite the propeller, and *Woods*, who found in a silver plate a spot opposite the propeller that was burned, whereas the rest of the plate was good. Again, propellers can suck in air and air bubbles can cause odd effects if forced into contact with the cathode.

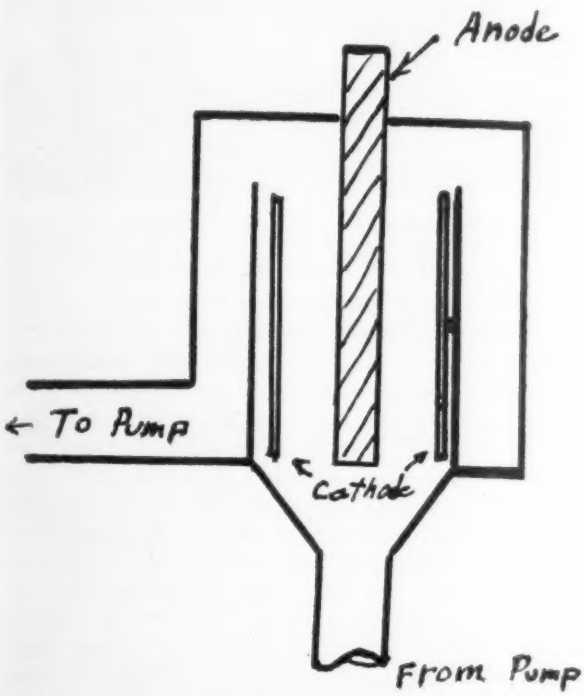


Figure XI. Simon and Lumley's apparatus for silver plating.

Rotational Cathode Motion Agitation

Rotational motion of the cathode is sometimes used in practice and very frequently in experiment. High current densities can be achieved by its use wherever applicable, yet it is also limited because the higher degrees of turbulence so vital to plating at extremely high current densities cannot be reached, or if they can, certain non-uniformities in the deposit may result.

Repeated experiments have shown that there is a limit to rotational motion, beyond which no further increase in current density can be achieved, under a given set of operating conditions. This is illustrated by the curves of Figure IX.

The explanation for this behavior is perhaps as follows: With the cathode rotating at a low speed there is a thinning effect on the stagnant cathode film due to the turbulence produced (Reynolds Number is increased). As the speed of rotation is increased the abrasive effect of the turbulent body of the solution on the thickness of the stagnant layer is increased and accordingly, a higher current density can be used. Soon, however, with the speed increased again, a point is reached where the catholyte begins to rotate along with the rotating cathode (it starts to centrifuge) and it can no longer exert the abrading effect on the film it did when there was more relative motion between catholyte and the cathode. This is the plateau point, and no further increase in speed of rotation will bring an advantage in increasing the current density possible.

However, if the conditions are changed so that the main body of the fluid is prevented from centrifuging, by means of properly placed baffles in the plating tank increased speed of rotation results in a further thinning of the film, permitting higher current densities to be used. Even here, with a given set of baffles, a limit is likewise reached, as shown by the second curve.

It is also of interest to point out that as the speed of rotation increases, in general, the resistance of bath goes up and higher voltages are required to produce the desired currents than would be required at lower speeds of rotation. This may be due to entrapped air, possibly, or because the ions themselves tend to be centrifuged away from the cathode. Air

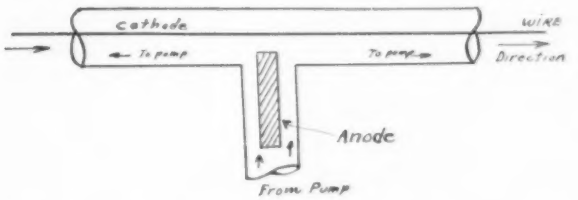


Figure XII. Basic principle of high-speed wire and tape plating machine.

bubbles may become attached to the cathode and cause material roughness. There is also a good possibility of non uniformity in plating because less of the air sucked in by the rotation will reach the bottom of the cathode than the upper part.

Air Agitation

Air agitation is frequently used in commercial electroplating baths. It is fundamentally a better method for producing turbulence than cathode rod motion.

In the cases where oxidation is an important factor, air agitation cannot be used. Another objection to it (that of stirring up the sludge and dirt in a tank) is the same for any form of agitation, more or less, and it is now well known that any agitated bath must be continuously filtered and as pure as possible. The possibility of introducing oil-bearing or contaminated air from the compressor can be overcome by an appropriate filtering and trapping system, so this objection is no longer valid. The only serious objection, and one that cannot be overcome, is the fact that the more air bubbles introduced into the systems the higher does the electrical resistance of the plating bath become because the paths the current must take are increased in length, as is indicated in Figure X. The electrical current cannot pass through air.

This in effect limits the amount of turbulence that can be produced, because as the bubbling is increased a point will be reached where electrical contact may be lost with the cathode or the overall resistance is so high as to render the operation uneconomical. There

is no way at present of comparing air agitation with cathode rod motion but it has been estimated that a cathode rod would have to move at a speed of at least 2 ft. per second to equal in effect the average air agitation used in electrotyping work. 200 ASF in an acid copper bath is readily achievable at room temperature with air agitation, whereas with cathode rod agitaton as commonly used, this limit cannot be reached without burning.

Direct Movement Agitation

In the cases of wire and tape it is possible to achieve a high degree of turbulence by the motion of the wire or tape alone, moving at high speed in one direction. Wire and tape can be readily moved at speeds in excess of 10 ft. per second, this in turn permitting the use of current densities of 1000 ASF and more, particularly where there is liquid motion agitation as well. Where the speed of motion is 10 ft. per second, the Reynolds Number may be somewhere between 30 and 50, indicating a fairly high degree of turbulence. It is important that there be auxiliary agitation along with the direct motion, to eliminate the effect of a depleted zone, described previously under cathode rod motion agitation.

Fluid Flow Agitation

Agitation by direct fluid flow is perhaps the most fruitful line of agitation for investigation because it offers remarkable advantages in those cases to which it is suited.

In direct fluid flow agitation, the object to be plated is placed in the path of a rapidly moving stream of electrolyte. Under proper conditions the Reynolds Number can be increased indefinitely without introduction of air into the system, and as a result amazingly high current densities become possible.

Simon and Lumley, using an apparatus something like that shown in Figure XI, were able to get silver deposits on the inside wall at 800 ASF. These deposits were spongy, but this undoubtedly was due to the fact that their electrolyte was not properly adjusted in composition for such a high current. They were readily able to get bright smooth and adherent deposits using the same electrolyte at current densities in excess of 200 ASF with a considerably lower flow velocity.

The writer, making use of the extra turbulence created by sudden expansion, change of direction and division, has successfully plated out gold at current densities in excess of 1000 ASF using an apparatus, the basic principle of which is shown in Figure XII. The first working model of this machine (patent applied for) (shown in the photograph of Figure XIII) was capable of putting a substantial deposit of gold on wires travelling 15 ft. per second and more, and the biggest problem was in getting sufficient current carrying capacity in the wire. The writer estimates Reynolds Numbers in the neighborhood of 200 and more were produced in the Tee.

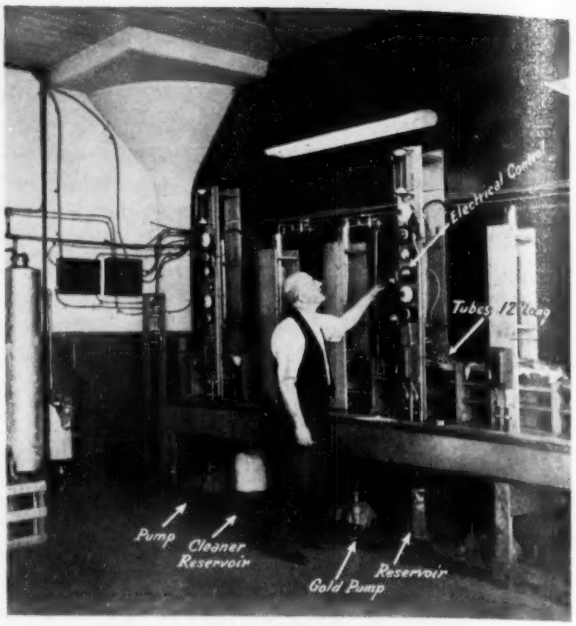


Figure XIII. Machine for plating gold on wire at high speeds.

Other Types of Agitation

Ultra-Sonic vibrations have been applied to plating baths in attempts to destroy the polarization film (stagnant layer) and thus achieve high current densities. The vibrations are of such high frequency that it is quite possible the ions themselves are jiggled about, but definite node patterns are formed which cause a non uniform plate, and the motion seems to be of insufficient amplitude to produce the desired effect.

Imposition of alternating current or pulsating current is also fundamentally a form of ion agitation which is more successful than Ultra-Sonic vibrations in permitting the use of higher currents. In effect the cations move two steps forward and one step back. This, it would seem, is much more effective in breaking up the stagnant layer. However, the limiting current densities attainable with this technique are below those attainable with other types of agitation, probably because the amplitude of the motion is insufficient to effect the thickness of the stagnant layer to any great extent, once a certain minimum thickness has been reached.

It is quite possible that a combination of one or more of the types of agitation described here will permit the use of enormous current densities with good results, with metal being plated out at a rate to make electroforming truly competitive with other forms of metal fabrication. Thus, *Bancroft's* Fifth Axiom, which says, "If a given solution will give a good deposit at any current density it will give a good deposit at *any higher* current density, provided conditions at the cathode surface are kept constant" is as true today as the day it was first enunciated. There is theoretically no reason why we cannot plate out metal at 10,000 ASF! With an acid copper bath giving a sound plate at 1000 ASF, .1" of copper can be plated out per sq. ft. in an hour. At 10,000 ASF, 1" of copper can be plated out sq. ft., in an hour! The sky's the limit, but a lot of research in fluid mechanics, as it effects electroplating, is required!

Design of Plating Range Cells

By J. B. Mohler, *New Castle, Pennsylvania*

EDITOR'S NOTE: In this article the author discusses the factors that effect the design of plating cells for solution control and points out how special cells provide more accurate information than standard cells in some cases.—ED.

ANY geometrical arrangement that will produce a change in current density over a cathode can be used for the design of a plating range cell. Thus a piece of steel can be hung in a bath with an edge facing the anode to produce a range of current densities across the cathode. Or the piece of steel can be bent so that the edge of the lower portion faces the anode as in the well known "bent cathode" test.

With a little experimentation it is possible to design many arrangements suitable for plating range purposes.

It is the purpose here to point out how the principle of plating through a slot is useful for plating cell purposes.

The simple arrangement of Figure 1[1] illustrates the use of a slot to produce a range of current densities. The current enters through the slot and the current density decreases along the cathode as the distance from the slot increases. Thus the slot acts like an anode and it may be referred to as a "slot-anode." The slot-anode is a source of current for current distribution purposes just as surely as if a real anode were in the same position. But the slot-anode has two advantages. First, it will not polarize. Secondly, the composition of the solution will not change as it would in the presence of a real anode. The position of the real anode will not affect the distribution of current through the slot. The real anode may be large or small and it may be in front of the cell (Position A) or behind it, (Position B) Figure 1.

In the absence of polarization the current density along the cathode will vary as the inverse square of the distance from the slot. However, in most plating baths cathode polarization has a considerable affect on current distribution. Therefore, the cathode current density will vary as some inverse power (less than 2 in most cases[2]). However, even where cathode polarization is high the change will be great enough for plating range purposes.

The arrangement shown in Figure 1 is very convenient for analysis of the CrO_3/SO_4 ratio in chromic acid baths[3]. At the optimum ratio the widest band of deposit will be produced on the cathode. The test is is sensitive and eliminates the need for chemical analyses. Also it has the advantage that it can be adapted to catalysts other than sulfuric acid.

The cell applied to plating tests for a chromic acid bath has a centered slot, which is an advantage because it produces a wide, easily recognized band of deposit. However, the deposit is the same on either side of the slot so that in other applications an end slot is convenient. A cell using an end slot is shown in Figure 2.

In Figure 2 the cell is also enclosed in a box so that tests may be run with a small portion of solution. A box type cell or an immersion type cell may

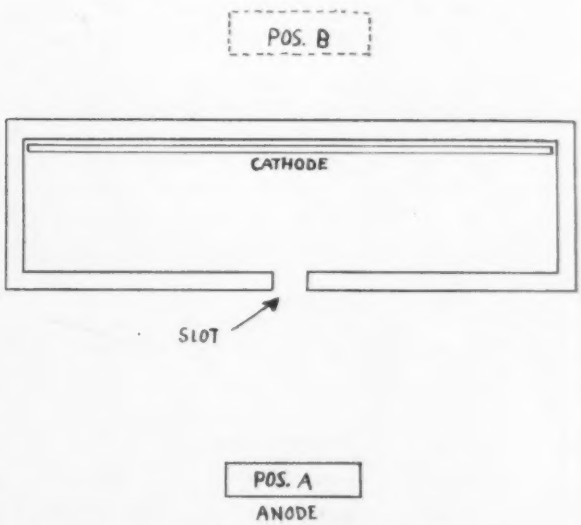


Figure 1. An immersion type single slot cell useful for the control of the CrO_3/SO_4 ratio in a chromic acid bath.

The Author

Mr. Mohler is presently Director of Research for The Johnson Bronze Co. of New Castle, Pa. Prior to that he was Research Chemist at the Cleveland Graphite Bronze Co. A graduate of Western Reserve University, Mr. Mohler has written many articles for the metal finishing field.

be used either with a centered slot or an end slot. The choice of a cell depends on the application.

The cell of Figure 2 should be useful for general testing purposes. Such a cell is convenient where a portion of the bath is tested and corrections are made and further tests run until a satisfactory plating range is obtained. For routine testing at the plating tank an immersion type cell used directly in the tank would be convenient. Also the immersion type cell is convenient for testing hot solutions were the small box type cell will not hold the heat satisfactorily during the testing time. In this case an immersion type cell can be suspended in a beaker that is easily kept hot, by use of a hot plate.

The slot type plating range cell is convenient for routine testing of over-all plating range. Thus it can be used for a single check on plating quality, addition agent control, detection of impurities in the bath, or covering power tests. The characteristic drop in current density along the cathode produces a wide current density range. However, the distribution of current over the cathode is not the best for accurate determination of the current density at a particular line on the cathode.

For accurate determination of the current density at which a change in plating conditions takes place, a multiple slot cell was developed. By using a number of slots and by adjusting the spacing of the slots and the size of the openings it was found that a change in current density could be produced across the cathode that was almost linear. Although such a cell does not have the wide range of the single slot cell it lends itself to more accurate location of the end of a bright plating range in terms of a current density. Such a cell is useful for detecting small changes in plating bath performance or for construction of plating range diagrams.

In the single slot cell the average current density will correspond with a specific current density of the same value approximately in the center of the cathode. If tests are made at several average current densities, a critical line on the cathode will be found to shift with the change in total current. In the absence of calibration data the critical current can be determined by successive tests to locate a line approximately in the center of the cell.

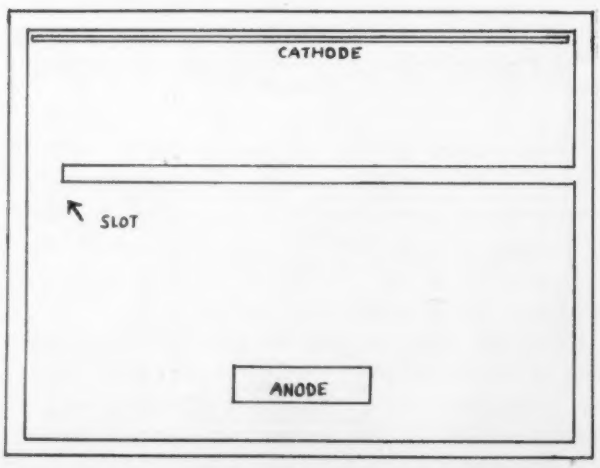


Figure 2. A box type single slot cell useful for general plating range purposes.

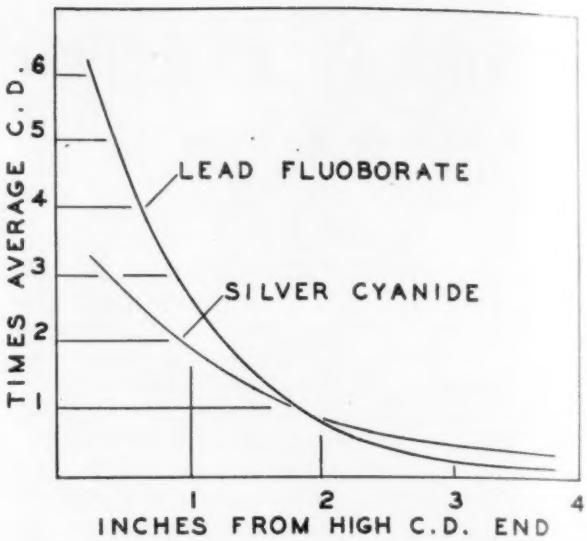


Figure 3. Calibration curves with silver cyanide and lead fluoborate baths for a 4 inch single slot cell.

For practical testing purposes calibration of the cells is not necessary. For such purposes a series of tests are run on fresh baths or on baths known to be at optimum performance. Any subsequent tests showing a more narrow plating range or a shift in plating range then indicate that some correction of the bath is necessary. After trial additions of bath constituents or purification, further tests will indicate corrections to be made to restore a bath to the original plating range. The plating range tests become of most value when they become routine tests and when a log is kept of the results, or when the cathodes are lacquered and saved for reference. Since the cathodes are flat, thin sheets they can be conveniently filed.

Although a plating range cell may be used without calibration it is nevertheless convenient to know the variation in current density across the cathode.

Figure 3 shows calibration curves for a 4-inch single slot cell with a ¼ inch slot one inch from the cathode. The calibrations were made with a silver cyanide bath and a lead fluoborate bath. These calibrations give an indication of the general variation in current density that may be expected for alkaline and acid baths.

Figure 4 shows a calibration for a 4-inch multiple slot cell where a lead fluoborate bath was used for calibrating purposes.

Figure 5 is a scale drawing of the multiple slot cell.

Silver cyanide baths and lead fluoborate baths are convenient for calibrating purposes because the deposit can be easily stripped from an unetched cathode, sectioned and weighed. Both baths deposit metal at 100 percent cathode efficiency and they are about of medium throwing power for an alkaline and an acid bath.

A four inch cell is a convenient size for general testing purposes but other sizes are at times more convenient. A large cell can be more easily read while

a smaller cell may be convenient where conservation of solution is important, such as the testing of precious metal baths. If data is obtained on a four inch cell it can be directly applied to another size by keeping all dimensions in proportion. For instance a two inch cell should be constructed with a ⅛ inch slot ½ inch away from the cathode to obtain the same range as a four inch cell at one-half scale.

Cell Fabrication

Cells can be easily made from methyl methacrylate resin using methylene chloride to stick the pieces together. This well known plastic is sold under the trade names of "Lucite" and "Plexiglas" and instructions are available from the manufacturers for sealing, forming and machining. It is an excellent material for construction of plating test cells because of its clarity and its remarkable resistance to corrosion in both acid and alkaline solutions. In general the material can be worked with the same tools used for working with hard wood and if good square parts are made, leak proof cells can be assured. The plastic comes in two types, the commonly used type and a type that softens at higher temperatures. This second type will not soften up to the boiling point of water for the small strong shapes used for plating cell purposes. The high temperature type is a little harder to machine and requires longer soaking times for sealing with solvent but it can be satisfactorily handled and is worth the extra effort.

More data on plating range cells are desirable. Although plating tests are becoming more popular there are not enough plating standards for the common plating baths. This need not discourage the use of the cells since test plates are easily run on a specific bath. However, it would be convenient to have diagrams of the common plating baths in terms of current density at operating conditions. It would then be an advantage to have accurate calibrations of the plating range cells for all baths. Some work has been done along these lines and the work of *R. O. Hull* with the inclined cathode is particularly

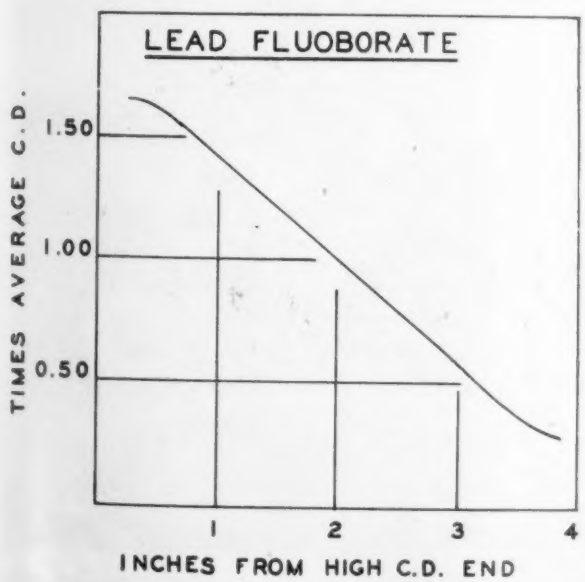


Figure 4. Calibration for a 4 inch multiple slot cell.

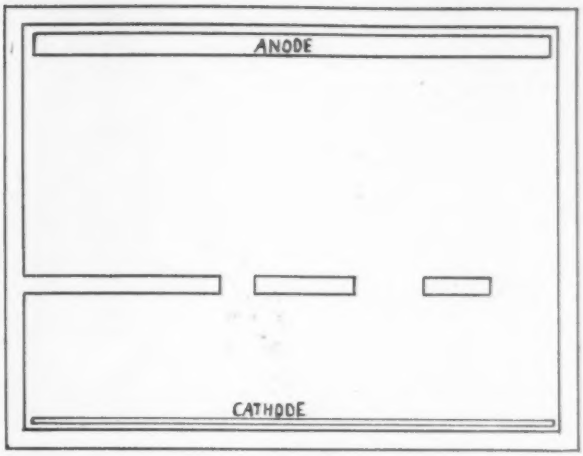


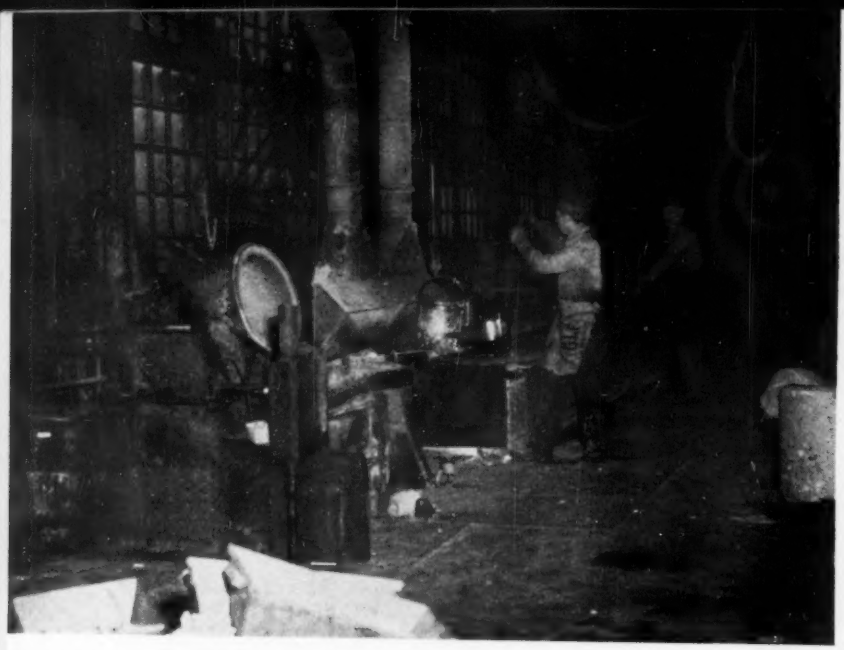
Figure 5. Scale drawing of a multiple slot cell specifically designed for accurate plating range interpretations.

notable. Nevertheless there is need for more knowledge of the effects of change in concentration at the cathode, of time, preparation of the cathode, total current and agitation. There is also a need for more plating range diagrams showing the effect of current density and the important bath variables, such as pH in a nickel bath. When an accurate plating range diagram and an accurate cell calibration is available it becomes possible to put a plating range cell to its best use. With such data the bath composition may be altered from recommended conditions and performance can be followed by plating test. It is often desirable to do this for specific plating applications. If the size of an anode is limited because it has to be placed inside of an article, excessive anode polarization often makes it necessary to operate at lower than the recommended current densities. By changing another variable such as pH or temperature a lower current density may be practical but bath balance becomes important. If bath balance cannot be maintained for satisfactory periods of time the new conditions will not be satisfactory. A rapid shift in plating range by a plating test will indicate such a happening and a plating range diagram will indicate a new set of conditions for possible operation. In another case it may be desirable to lower bath temperature in order to use wax as a stop-off in a warm bath. Specific data will be an aid in this case and in many others where plating problems do not fit into the established limits for a bath.

If one uses a specific bath extensively it is worth while to establish plating range tests outside of the routine limits of the bath. Such data is valuable, as indicated, to meet emergencies. Further it is useful in that it serves as a background for interpretation where a plating range test indicates a shift in plating range.

References

1. *J. B. Mohler* and *R. A. Schaefer*, The Monthly Review *34* 1364 (1947).
2. *R. A. Schaefer* and *J. B. Mohler*, Trans. Electrochem. Soc. *86* 431 (1944).
3. *J. B. Mohler*, The Iron Age, Dec. 4, 1947, p. 75.



View of galvanizing tank showing basket load of parts being lifted by air hoist from the spelter bath.

High Production Galvanizing of Small Parts

By Walter Rudolph, *Erie, Pa.*

COMPLEXITY in modern manufacturing is reflected by increased demands for many special types of nuts and bolts. Some time ago the *Buffalo Bolt Co., North Tonawanda, N. Y.*, a leading producer in its field, devised and built special galvanizing facilities to aid in meeting these demands.

While maintaining galvanizing quality, the new installation upped the department's capacity by hundreds of pounds daily and substantially reduced unit cost.

For the record, Buffalo Bolt now annually produces about 600,000,000 bolts in great variety, in addition to large quantities of nuts and related hardware. Through its own rolling mill the plant processes between 3500 and 4000 tons of billets every month, feeding manufacturing needs.

Some stainless steel and a number of chrome, nickel and other alloys are included in production materials, but for most customer requirements low and high carbon alloys, such as SAE. 4037, 3135 and 1335, are satisfactory.

Manufacturing involves many precision machine tools such as centerless grinders, semi-automatic equipment for threading, and nut-making machinery. Many of the installations in the latter category were designed and built by Buffalo Bolt engineers.

Among the special types of bolts mentioned above are unique applications for tractors, refrigerators, scaffolding fasteners, button-head rivets for rail equipment, T-slot bolts for precision machinery and numerous items for the automotive industries. About 1,500

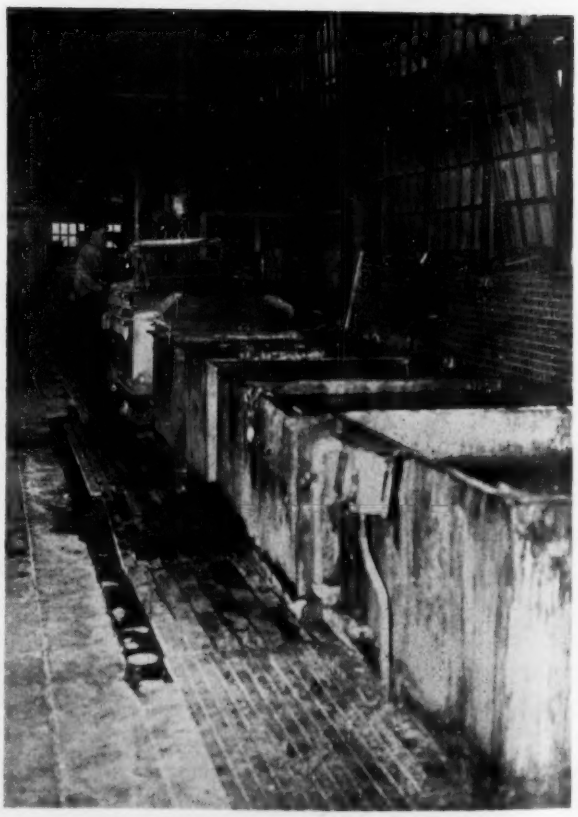


Fig. 1. Line of cleaning and pickling tanks for removing heavy oils from parts before galvanizing.

men and women are employed in the entire production picture.

Practically every machining operation utilizes "dope" or oil. Naturally, galvanizing must be preceded by thorough cleaning to remove all machining lubricants. Prior to the new galvanizing installation the plating department as a whole was proving inadequate to production demands, with cleaning, other stages of plating, and materials handling more or less scrambled and very costly.

To meet the problem, and provide for future contingencies, it was decided to erect an entirely new building to house the galvanizing operations. In effect, the structure is a 60 x 250-ft., ground floor addition. The galvanizing installation of special interest here occupies about a sixth of the total floor area, in one of its corners.

It is a straight-line setup, fed at the first stage, or cleaning tank, by a narrow gauge railway that also takes away finished items at the other end. Main line of the railway cuts through the department's middle, with spurs angling off to service galvanizing facilities. It is a continuation of lines running through the entire plant, a prime factor in materials moving. Various types of jitneys or tractors provide pushing or pulling power for the railways small, box-like cars, and are hailed when needed.

Electric and air-powered hoists travel ceiling tramrails over work stations and the various tanks in the cleaning and galvanizing departments. Incidentally, the air hoists were installed because they give a faster lift and drop between galvanizing stages. Specially built, mechanically dumped hoppers are another feature of materials handling.

Fig. 2. Steam heated centrifuge for spinning off excess zinc from the basket load of small parts.

Fig. 3. Galvanized parts being re-loaded into tote pans after they have been quenched in water to set the coating. Note rollers under man's feet to carry tote pans to next operation.

About 1,500 lbs. of bolts and other items are galvanized per hour, volume varying according to size and weight of pieces. Three men are usually employed in the process. Containers that travel the galvanizing setup carry up to 1,000 lbs.

They first enter a 450-gal. degreasing tank containing a strong, caustic solution that is held at boiling by gas heat at the tanks bottom. After the boil, a lift and drop into the adjacent cold rinse tank is made. Third in line is a 3′ x 4′ x 16-ft. tank of sulphuric acid pickling solution, another 15-min. bath.

Following a second cold rinse after the pickling tank, containers drop into a tank, equal in size to that for pickling, containing a 180-degree solution of zinc-ammonium-chloride. This is another 15-min. stage. Containers proceed next over a dry-and-preheat steel plate, warmed underneath by gas fire. They are dumped on this plate and contents are raked at intervals for about five minutes. When dry the pieces are shoveled back into a container which now moves but a few feet and is dipped into the hot galvanizing tank.

This tank holds 20 tons of spelter, fired below by gas to 860° F. Temperature is maintained by automatic thermostat controls. After two minutes of galvanizing, the container is quickly removed from the tank by air hoist and deposited in a centrifugal machine at the tanks end. Whirling the contents at 750 rpm. removes all excess spelter, spattering it against

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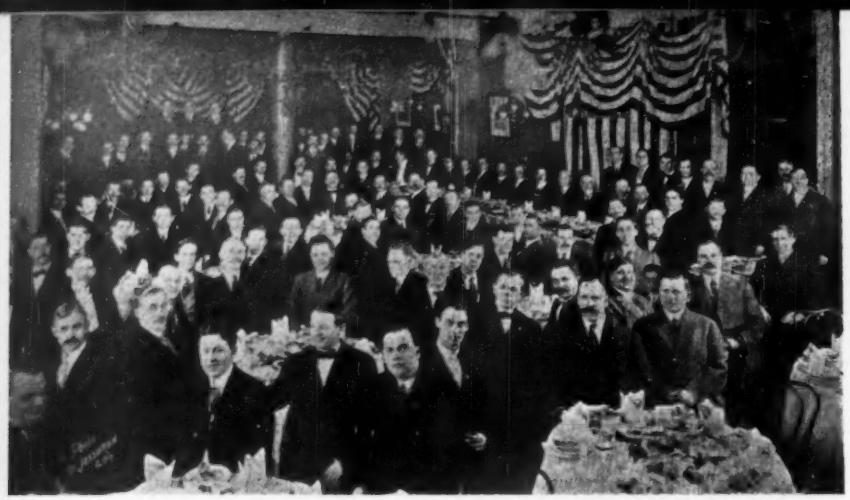


Second Annual Banquet of the National Electroplaters Society, 1911. Officers for that year were: Charles H. Proctor, president; George B. Hogaboom, secretary, and Royal F. Clark, recording secretary.

All Our Yesterdays—Part VIII

By George Spelvin

AS THE first decade of the twentieth century drew to a close, both the electroplating industry and the country as a whole showed signs of passing through a painful transitionary period. On the national scene such signs were most evident in the news of labor and the trusts. Strikes were both frequent and violent: rioting marked street-car strikes in Philadelphia and Columbus, and in the former culminated in a city-wide general strike. Coal miners, regular as crocuses, signalized April 1 by staying out of the pits; bakers struck in New York, fatal race riots took place in Illinois, and many other disturbances gave evidence that the relationship between capital and labor was entering a new phase. Meanwhile, many of the anti-trust suits, begun under Theodore Roosevelt, were emerging from the courts: sugar trusts, railroads, steel combines and others paid large fines.

From the plater's standpoint the year 1910 was also one of transition, though the evidence was perhaps more subtle. The technical press was giving a greater proportion of its space to articles in praise of the value of theory, of chemical training for the electroplater, of closer control of operations; and in deprecation of the "old-time" plater and his "dark-of-the-moon" methods.

For instance: "There seems to be a general impression among platers that the chemist is merely a theorist and they are inclined to smile whenever a chemist attempts to show them some points about plating . . . But there is no doubt that the plater is beginning to realize the advantages that chemistry holds for him and there are many who are spending their days hard at work and their evenings pouring (*sic*) over chemical text-books or in classes at night school . . . The future will see the electroplater a chemist with absolute certainty, unless he be so shortsighted as to neglect the psychological moment that opportunity offers."

Or again: "Electroplating is essentially an electrochemical process and therefore it is far easier for a chemist who knows the theory of electrolytic action to learn the practice of plating than for the practical plater to learn the theoretical. Eventually the plater will also be a chemist as a matter of self-protection, as otherwise he will find himself being replaced by the younger generation . . . The old methods of mixing solutions by adding a little of everything at hand until the solution works satisfactorily is (*sic*) gradually disappearing as the plater begins to realize that possibly some of the ingredients are unnecessary . . . There are but few of the "trade secrets" that would stand the light of day and many owners of such "secrets" would wonder how they ever had faith in them should they once be submitted for unbiased com-

Fig. 1. Photograph of a flexible emery wheel that was developed in 1910. The wheel is made up of pieces of emery cloth edge-mounted on two rattan center rings.

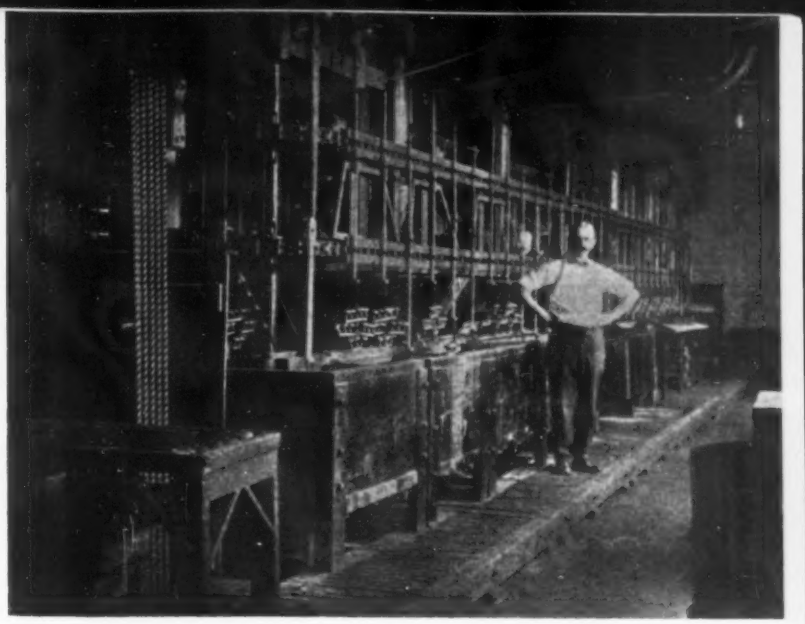


Fig. 3. Automatic Plating Machine installed in 1910 in the plant of the Russel and Irwin Mfg. Co., New Britain, Conn. Foreman plater Hugh Kelly is shown. A similar type machine was installed about the same time at Yale & Towne Mfg. Co., of Stamford, Conn.

ment. The chemist is in reality an enemy to trade secrets . . . On analyzing a secret solution he discovers that the secret so jealously guarded is merely some commonly used solution with some inert material added which is useless except so far as it gives the owner of the secret a good excuse for secrecy and an excellent chance to hoodwink others.

"The chemist figures theoretically the quantity of different materials, knows their properties and action, whether they will mix without a chemical change taking place, whether they will have a poisonous effect and all the large and small things necessary to the sucfessful outcome of his work.

"The day of the old time plater and his secret formulas and methods is passing and passing rapidly, and modern methods and modern platers are coming rapidly to the fore, and before long chemistry will be the open sesame to the best positions offered."

The author of this possibly over-optimistic view of the magic of chemistry closes with an earnest plea to his fellows to publish the results of their work in trade papers, to do away with secrecy, and perform careful and accurate experiments.

Not content with these flank attacks on the oldtimers, another author contributed an "imaginative portrait" in which the victim got both barrels point-blank:

The oldtime plater was "a man with an important and secretive air, always moving about the plating room with a copper dipper in one hand and a wooden paddle in the other, always stirring the contents of the dipper. At times he would disappear in a little room . . . where he mixed his solutions, and he would bring out one dipperful at a time, pour it in one of the tanks, and tell me to show him some of the first work I would take out of that tank in the morning.

"He was always sure to erase the names of chemicals on packages containing them as soon as they came in. How carefully he guarded his secrets! Had he not paid for his formulas. Why should he give them to anyone? . . . But he is nearly all gone now. Now and then you may still run into one, and he arouses a feeling of pity in you—pity for himself and for the firm that employs him. He is still keeping his secrets, still going along as he did years ago, turning out as much work as he did years ago—and as a rule getting as much pay as he did years ago."

Secret formulas apparently were not confined to the plating end of the metal business. The superintendent of a brass foundry has something to say about fluxes: "The virtues claimed for the many metal scavengers now being exploited by these scrupulously dishonest and unscrupulously honest salesmen are many and varied; our quarrel is with the smooth guy who slips one over on you without half trying. There is at present on the market a flux which is sold with the assurance that casting troubles are about to disappear, while the only thing that happens is the disappearance of the flux."

In April the results of the latest census were announced: America was a country of 91,972,226 souls, or if one included Alaska, Hawaii and Puerto Rico the figure was 93,402,151. The center of population was Bloomington, Indiana. Many of these people seemed determined to be in two places at once, for it was a year of new speed records in all fields: in January Glenn Curtiss carried passengers in a plane at 55 miles per hour, in May he flew from Albany to New York in 2 hrs. 32 min.; other flyers set new altitude records.

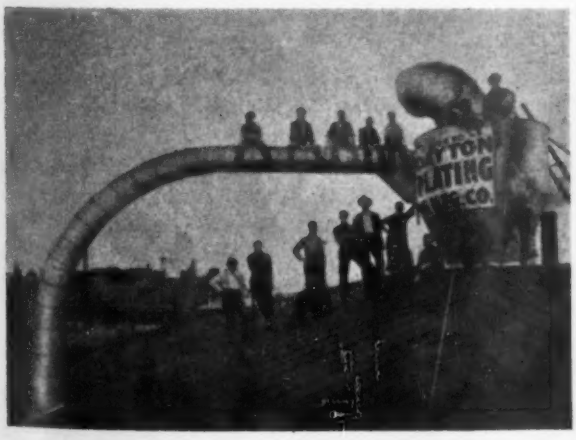


Fig. 2. A large dust separator installed in 1910 at the Dayton Plating & Mfg. Co., Dayton, Ohio. The separator was built and installed by the Kirk and Blum Co.

culminating when Arch Hoxsey attained 11,474 feet in December and was killed only four days later in an airplane accident. In November a plane took off from the deck of a Navy cruiser.

Nor were the speed records confined to the air. In March Barney Oldfield went 130 m.p.h. in an automobile over the sands at Daytona; on May 21 two trains of the Michigan Central covered the 224 miles between Niagara Falls and Detroit in 224 and 217 minutes, respectively. And in August, Uhlan, a trotting horse, did a mile in 1.58 minutes.

The automobile industry was beginning to be of importance to platers. In an article on brass plating for automobile hardware, it was remarked that the attainment of a usefully thick deposit was a matter of great difficulty. The only method that can be recommended is to take the work out at intervals, scratch-brush it, and then return it to the tank. Four to five hours' total plating time is required; and as an afterthought the author remarks that even thick deposits don't stand up very well. Several correspondents soon took issue with these statements, one remarking that he had brass-plated a part for eighteen days continuously, had got a thick deposit of good quality with no scratch-brushing.

We find a warning against the use of excessive voltages in plating. Rheostats merely waste power, whereas if the rheostat is not of sufficient capacity the current will be too great and the work will be burned. This is followed by a note on how to make a rheostat, which explains that copper is not a good material for resistance wires; and German silver or brass will crystallize and fail. Later in the year the editor returns to the subject, remarking, "Many a rheostat is of no value to its owner for the reason that it does not cut down the current to the necessary degree. We believe the day is coming when much more attention will be paid to this heretofore neglected portion of plating equipment, so that it will not be necessary, as it now frequently is, to resort to many hundreds of feet of iron or German-silver wire coiled around the tank or room."

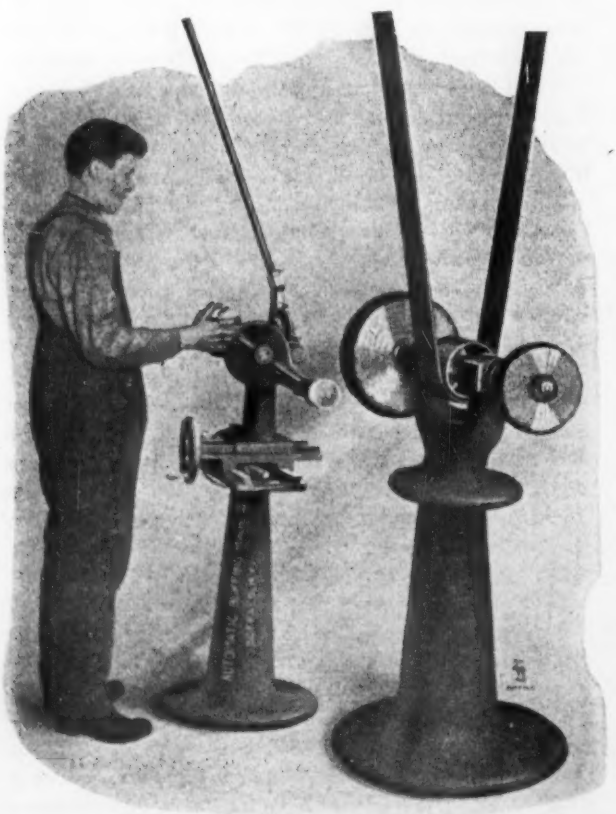
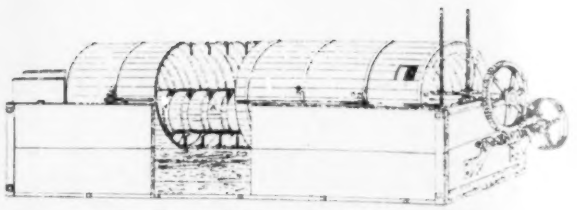


Fig. 4. Automatic buffing machine developed by the Automatic Buffing Machine Co., of Buffalo, N. Y. in 1910. This type of machine was widely used at the time for buffing clock cases.



THE CONTINUOUS MECHANICAL PLATER.

Fig. 5. A continuous mechanical plater developed in 1910 by the Globe Machine and Stamping Co., of Cleveland, Ohio. Sizes were available to plate 6 tons of work per 10 hr. day.

Should plating solutions be stirred? "Much hue and cry has been made within the past few years about the enormous advantages of agitated plating solutions, and it has resulted in an accompanying agitation of the plating trade. Many platers who are always active to grasp a new idea, think it is one of the necessary improvements in the plating room.

"Allow us to suggest that it will be found advisable to look into the matter before adopting it." While it is true that acid copper solutions should be stirred, "in the cyanide solutions agitation is the least desirable as it seems to expose the solution to the air and results in aeration and decomposition of the cyanide."

Cyanide baths received considerable editorial attention. Their regeneration by the use of barium cyanide to precipitate barium carbonate is noted as a new German improvement, but unfortunately no American producer seems to offer barium cyanide for sale.

The advantages of silver cyanide over silver chloride for making up the silver-plating bath are summarized. Rather unconvincingly, the author remarks, "It has never been shown that cyanide of silver gives any better deposit than the chloride, but its advantage lies in other directions. In the first place it is theoretically correct while the chloride is not . . . The potassium chloride (formed) is an inert salt and simply fills the solution with useless material."

Sodium cyanide was becoming commercially available, and the price advantage over the potassium salt raised the question as to why it was not more widely used. "It is as good as potassium cyanide and even better in some respects." That argument isn't settled yet.

In 1910 America lost two of her best-loved humorists: Mark Twain died on April 21 at the age of 74, and William Sydney Porter (O. Henry) on June 5 at 42. Other names which turned up in the obituary columns were those of Mrs. Julia Ward Howe, writer of the Battle Hymn of the Republic, at 91, and Mrs. Mary Baker Eddy, founder of Christian Science, at the

age of 89. In this year also, the United States ratified the International Patent Convention; and Congress established the Bureau of Mines. In the Congressional elections, the Democrats captured the House of Representatives by 225 to 165 Republicans, but the news of that day was the election to the House of its first Socialist, Victor Berger of Milwaukee. The State of Washington gave votes to women; but female suffrage was turned down by Oregon, Oklahoma and South Dakota. And Andrew Carnegie gave $10,000,000 to establish a Peace Fund "to hasten the abolition of international war."

The Question and Answer columns of the plating journals reflected for the most part the usual troubles with nickel, copper and brass solutions. Of the less run-of-the-mine queries we may note a few:

Q. What strength of current is best for a rose gold finish on jewelry? A. At a rough estimate, about four amperes per square inch (*sic*).

Q. Do you know of a good aluminum-plating bath for electroplating iron and brass with aluminum? A. No.

Q. What can be used as a brightener in nickel-plating solutions? We understand that there is something that can be added for this purpose. A. Both boracic acid and salammoniac are used in nickel solutions for producing a so-called bright nickel deposit but it must be borne in mind that such a deposit is not equal to a buffed one and it can only be very light.

Q. I have trouble with my brass solution which plates very slow. It is three years old . . . A. Your solution is old and needs invigorating. Throw away a portion and add new solution.

Q. I wish to deposit an alloy of nickel and chromium on mica. It must adhere to the mica and not peel. The alloy is called "Nichrome." Please inform me how it can be done. A. We are unable to give you any information. To deposit nickel and chromium together has never been done and we doubt whether it is possible to do it.

Q. What is the "soot" used in acid dips, and why is it used? A. The type used is soot from chimneys in which hard wood has been burned. Coal soot is not satisfactory. Its value is that it forms nitrogen tetroxide from the nitric acid: if red nitric acid is used in the first place the soot is not necessary, but even so it is more convenient to use it.

New processes which received attention included two from England: a "wipe" plating which employed a pasty mixture for plating by rubbing on the work; and advances in Coslettizing, one of the forerunners of the modern phosphating processes. The wiping plating was known as "Galvanite" and one opinion was that "The process is one that appears to the ordinary observer as almost a revolution, but . . . there will undoubtedly be numerous objections found and it is doubtful whether it will affect the electroplating industry to any extent."

Copper was 14 cents a pound in 1910; tin 32.5 cents and zinc 6.25c; but aluminum was 28c and nickel 60c. And in a review concerned with the costs of plating, it was pointed out that because "The wages of a plater are three dollars a day, and figuring the polisher's time at thirty cents an hour" it costs at least a dollar an hour to operate a nickel tank.

The editors of the technical journals were, as usual, generous with helpful hints and admonitory advices to their subscribers. But though many of the troubles against which they were zealous to guard their readers have been washed away by the waters of time, one piece of advice remains everlastingly valid. The author was referring to the use of lacquers, but his prescription is far broader than any one technique: "I am convinced," he wrote, "that the best method to use lacquers is to mix them with brains and apply them with enthusiasm."

That should hold you till 1911.

HIGH PRODUCTION GALVANIZING

(*Concluded from page 63*)

the machine's bottomless housing from where it drops to the base plate.

These droppings are shoveled into the spelter tank several times daily. To go back a step, fumes from this tank are drawn by electric fans into two exhaust pipes that are vented along one of its sides.

The container of galvanized pieces is dumped into a perforated hopper that sits in water. In a short time the water-quench sets up the coating. Then mechanical power is engaged to slowly up-end the hopper, which quickly drains, and the pieces slide down a sloped wall of the hopper into a tote pan held by a worker, or into a larger steel box that rests on a floor-level roller conveyor.

When pieces are dumped into small tote pans, these are stacked on a large steel plate positioned on the roller conveyor. The latter travels the load a short distance to the railway previously described. When loaded, rail cars are moved to sorting tables, packaging and shipping.

Buffalo Bolt has also built a chain-galvanizing device that rests against the wall next to the installation described. When chains are received from an area firm, the device is positioned over the line of tanks and carries the chain lengths through the galvanizing stages. Upon leaving the hot spelter dip, a chain section is snapped to remove excess coating.

CORRECTION

In the article on "Throwing Power" by *A. Mankowitch*, which was published in the July issue of METAL FINISHING, an error in two formulas was called to our attention by the author. On Page 53, the first formula for throwing power should read

$$\text{Throwing Power} = \frac{I_1 \times Q_1}{I_2 \times Q_2}\left[1 + \frac{C}{1}(e_2 - e_1)\right]$$

The second formula should then be

$$\text{Throwing Power} = 1 + \frac{C}{1} e_1$$

Determination of p-Toluenesulfonamide in Nickel Plating Baths

By Julius Sirota, * S.A.M. Laboratories, Columbia University, New York, N. Y.

This article is based on work performed under contract No. W-7405-eng-50 for the Atomic Energy Project and the information therein will appear in Division VIII of the National Nuclear Energy Series (Manhattan Project Technical Section) as part of the contribution of S.A.M. Laboratories, Columbia University.—Ed.

The compound para-toluenesulfonamide and other similar sulfonamides[1] are used in nickel plating baths to relieve stress in the metal plated from these baths and to reduce the grain size and increase luster of the deposit. The concentration of the compound used in the bath is limited chiefly by its solubility, i.e. 1 to 1.5 grams per liter.

Because of the importance of knowing the concentration of p-toluenesulfonamide in nickel plating baths for experimental and control purposes, a study for the determination of this "addition agent" in nickel plating baths was undertaken.

The following processes were tried or examined as potential methods for the determination of p-toluenesulfonamide, but proved to be unsuccessful for one reason or another. Standard nitrogen determinations, such as the Kjeldahl ammonia determination, or the action of nitrous acid to liberate nitrogen were unreliable in the presence of large concentrations of nickel salts. Oxidation with vanadic acid and subsequent titration with potassium permanganate[2] gave results that were not reproducible. Condensation of the compound with xanthydrol[3] or trioxymethylene[4] was not quantitative. The removal of nickel salts from solution was not feasible since they are present in large excess. Likewise a proper extracting solvent and method for the p-toluenesulfonamide could not be found.

The present method makes use of the chlorination of p-toluenesulfonamide to p-toluenesulfonedichloramide, known as Dichloramine T. The amide is then solvent extracted, dissolved in acetic acid and excess potassium iodide solution, and titrated with sodium thiosulfate, using starch as an indicator.

The chlorination of p-toluenesulfonamide[5] proceeds in two steps:

(1) $CH_3C_6H_4SO_2NH_2 + NaOCl \rightarrow CH_3C_6H_4SO_2NCl^-Na^+ + H_2O$

(2) $CH_3C_6H_4SO_2NCl^-Na^+ + NaOCl + 2HC_2H_3O_2 \rightarrow CH_3C_6H_4SO_2NCl_2 + 2NaC_2H_3O_2 + H_2O$

Since reaction No. 1 takes place in alkaline media, there is interference with the nickel salts. It was thus found more convenient to use reaction No. 2 as the basis of this determination. It was also found more expedient to use commercially bottled chlorine gas as the chlorinating agent[6] in place of the acidified "liquid bleach" as shown in reaction No. 3.

(3) $CH_3C_6H_4SO_2NH_2 + 2Cl_2 \rightarrow CH_3C_6H_4SO_2NCl_2 + 2HCl$

Method

The determination as finally worked out runs as follows:

REAGENTS

1. Chlorine gas tank (Ohio Chem. Mfg. Co.), 80 lbs. pressure per sq. in., 5 cu. ft., equipped with a reducing valve.
2. Chloroform C.P.
3. Glacial acetic acid.
4. 30% Aqueous potassium iodide solution.
5. Sodium thiosulfate solution (approx. 0.2 N), prepared by dissolving 50 grams of $Na_2S_2O_3 \cdot 5H_2O$ in 1 liter of water and standardizing against pure copper or iodine.
6. 0.25% Aqueous starch indicator solution.

PROCEDURE

Pipette a 100 ml. sample into a 250 ml. separatory funnel and arrange the apparatus as shown in the accompanying figure. Commercially bottled chlorine gas is then bubbled slowly through the sample for 10 to 15 minutes at the rate of about 120 bubbles per minute, until the solution seems well saturated with chlorine. The excess chlorine is absorbed by a concentrated alkali solution as shown in the figure. A white suspension or precipitate forms if p-toluenesulfonamide is present. This suspension is then carefully solvent extracted with three 50 ml. portions of chloroform, and the chloroform layers are collected in a 250 ml. breaker. The chloroform is then evapo-

* *Presently associated with Cathodium Metallizing Company, New York City.*

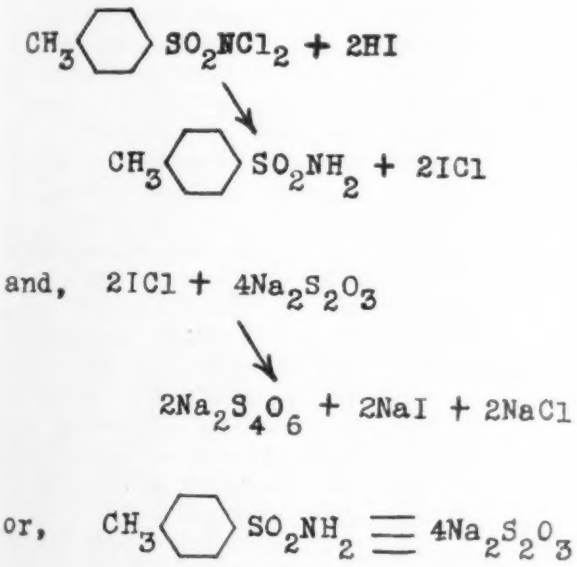
rated slowly on a water bath to about 5 ml. and then dried completely in a vacuum desiccator at room temperature. The precipitate is dissolved in 25 ml. of 30% potassium iodide solution and 5 ml. of glacial acetic acid. The resultant solution is then titrated with standard sodium thiosulfate solution using starch as indicator until the blue color just clears up.

CALCULATIONS

All calculations below are based on a 100 ml. sample of plating solution.

$$\text{Gms./Liter of para toluene-sulfonamide} = (\text{ml.} \times \text{normality of thiosulfate}) \times \frac{171.2/4}{1000} \times 10$$

where 171.2/4 is the equivalent weight of p-toluenesulfonamide according to the following chemical reactions:



Notes

1. If the concentration of the p-toluenesulfonamide is greater than 1.5 gms./liter, then the bath to be tested should be heated before the liquid aliquot is taken in order to dissolve the suspended para compound that may be present. The change in volume due to temperature must be taken into account in the calculations when this is done.

2. No blank has to be run, since the titration value of the pure nickel bath is zero.

3. The presence of wetting agents may cause some trouble due to excessive foaming, but can be avoided if care is taken in the bubbling of the chlorine and the extraction by the chloroform.

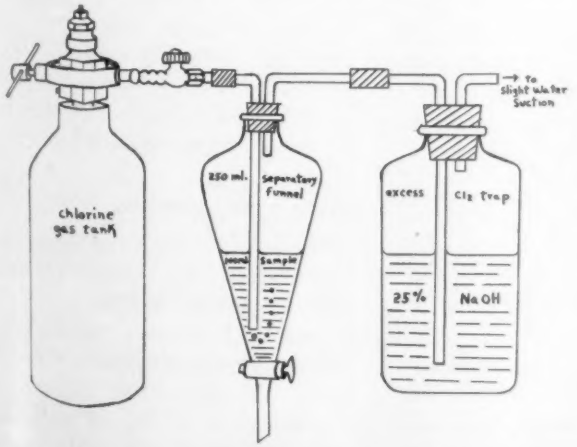


Fig. 1. Diagram of apparatus used for bubbling chlorine gas thru the sample under test.

Experimental Results

Typical results obtained with the above procedure were as follows:

A. Using a pure aqueous solution of p-toluenesulfonamide (0.979 gms./L.):

Test No.	ml. of 0.2183 N thiosulfate solution	gms./L. of p-toluenesulfonamide
(1)	10.8	1.01
(2)	10.3	0.96
(3)	10.8	1.01
(4)	10.5	0.98
		average = 0.99 ± 2%

B. Using a nickel plating bath containing 1.14 grams of p-toluenesulfonamide per liter:

Test No.	ml. of 0.2183 N thiosulfate solution	gms./L. of p-toluenesulfonamide
(1)	12.0	1.12
(2)	12.2	1.14
(3)	12.6	1.18
(4)	12.4	1.16
		average = 1.15 ± 2%

C. Using a nickel plating bath containing varying amounts of p-toluenesulfonamide as shown:

Test No.	ml. of 0.2183 N thiosulfate soln.	(Found) gms./L. of p-toluene-sulfonamide	(Actual) gms./L. of p-toluene-sulfonamide
(1)	7.8	0.76 ± 2%	0.752
(2)	6.6	0.63	0.642
(3)	21.0	1.96	2.003
(4)	8.9	0.83	0.843

Conclusion

A method for the determination of p-toluenesulfonamide in nickel plating baths has been presented. This method has been found to have a reproducibility and accuracy of ± 2%. Although specifically designed for p-toluenesulfonamide in nickel plating baths, this method should be applicable to other sulfonamides in other media.

The author wishes to express his appreciation to *Dr. R. B. Saltonstall*, Director of Research for the Udylite Corp., Detroit, Mich. for helpful suggestions in the preparation of this article.

References

1. U. S. Patent No. 2,191,813. *Safranek, W. H., Dahle, F. B., Faust, C. L.*, Plating, *35*, 39 (1948).
2. *Calcott, W. S. & et al.*, Ind. Eng. Chem., *16*, 27 (1924).
3. *Phillips, R. F. & Frank, V. S.*, J. Org. Chem., *9*, 9 (1944).
4. *McMaster, L.*, J. Am. Chem. Soc., *56*, 204 (1934).
5. *Chattaway, F. D.*, J. Chem. Soc., *87*, 148 (1905).
6. *Suter, C. M.*, "The Organic Chemistry of Sulfur," Wiley, New York, 1944, pg. 573.

The Influence of Sealing Treatments on the Protective Value of Anodized Coatings

By L. Whitby, M.Sc., Ph.D., F.R.I.C.

In this article the results of a comparison made by salt spray tests of the relative protective values of anodic oxide coatings on a fully heat-treated Duralumin-type alloy when subjected to various sealing treatments are given. An exceptionally high order of protective efficiency results from sealing treatments involving the use of chromates or dichromates.

IT IS well established that the protective value of anodic oxide coatings on aluminum and its alloys is considerably enhanced by treatments which reduce the original porosity of the coatings. Growth in thickness of anodic oxide coatings during electrolysis necessitates an oxide layer which is slightly soluble in the electrolyte, in order to ensure adequate porosity for the leakage current, responsible for continued growth. Thus, it has been shown by micro-sections that with sulphuric acid electrolytes aluminum develops anodic oxide coatings of porosity up to 36 per cent, with pore diameters of 0.1μ or less.[1]

Sealing treatments consist of hydration of the oxide coating by hot water or steam, immersion in solutions of easily hydrolized salts of weak bases (e.g., nickel or cobalt acetates) at controlled pH, impregnation with dichromate, chromate or silicate by immersion in solutions thereof, impregnation by double decomposition or other reactions to form sparingly soluble compounds in the coating, and impregnation with various organic materials, such as waxes, oils, greases, paints, varnishes or resins. The latter (organic) treatments function partly by impregnation of the porous coatings but mainly by the formation of a physical barrier resting upon the surface of the oxide films, and such treatments are often used to reinforce coatings sealed by one of the other methods.

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Sealing Methods

Hot Water

The anodic oxide coating on aluminum when first formed consists of amorphous and γAl_2O_3 with some $Al_2O_3 \cdot H_2O$ at the surface of the pores.[2] Immersion in water at a temperature in excess of 80° C produces considerable hydration of the oxide and, since the hydrate possesses a lower density than the oxide, hydration reduces porosity. The usual method for sealing in hot water consists of immersion of the anodized articles in water at boiling point for a time approximately equal to that taken for electrolysis.[3]

Salt Solutions

Hot solutions of salts of weak metallic bases, which hydrolize readily in solution to precipitate the hydroxide of the metal, are used for sealing, since the precipitate is considered to play an important part in the sealing process. In the case of films which have previously been dyed, sealing treatments involving nickel or cobalt hydroxides increase the fastness of some colors to light and solvents.

The salts preferred are nickel and cobalt acetates,[4] since with these materials the hydroxides are practically colorless in small quantities and hence do not stain the coating. The pH of the solutions is retained between 4.5 and 7.5 at 25° C when turbidity should be evident on boiling. Boric acid may be used as a buffer and the time of treatment is usually 15 minutes in the boiling solution.

Dichromate Solutions

Anodic coatings from sulphuric acid electrolytes, sealed in hot dichromate solutions, are colored yellow and such coatings possess exceptionally good resistance to corrosion.[5] The usual treatment consists of immersion for 15 min. in a boiling solution of 5 per cent potassium dichromate, but, by pH control, considerable reduction in the time of treatment is claimed to be possible without reduction in the protective value of the coatings.

Tomashov and Tyukina[6] have shown that chromate sealing consists of absorption of chromate, followed by the formation of either aluminum oxydichromate or aluminum oxychromate, followed in turn by hydration of the coating due to reaction with water. When the pH of the bath is increased from the 3.7 of a straight potassium dichromate solution, the rate of hydration of the film increases. In other words, due to increase in the rate of hydration, the rate of sealing increases as the pH is increased, a limit being set by rapid dissolution of the film at pH's in excess of 10.

The above investigators have shown that the extent of leaching of chromate from sealed films by sodium chloride solution or by water is less when the pH of the sealing bath is increased. Extremely effective and rapid sealing is claimed by the use of baths of pH between 6 and 7, due to high absorption of chromate and rapid hydration, with but little leaching of chromate from the coatings on exposure. In addition, the stability of the amphoteric Al_2O_3 is stated to be greatest between pH 6 and 7.

Soluble Silicates

The use of sodium and other soluble silicates has been claimed for sealing anodic coatings,[7] but no comparisons appear to have been made between sodium silicates of different Na_2O/SiO_2 ratios, although *J. D. Edwards*[8] has recommended the use of sodium silicate of Na_2O to SiO_2 ratio less than 1 : 3.

It is often not realized that starting from a 1 : 1 ratio for sodium metasilicate, sodium silicates are commercially available of Na_2O/SiO_2 ratios up to nearly 1 : 4, those below 1 : 2.9 being alkaline and those above 1 : 2.9 being neutral in reaction.

A modification of silicate sealing (which is usually carried out in hot solutions) consists of immersion of the anodic film in a dilute water-glass solution, followed by dipping in dilute acetic acid in order to precipitate silicic acid in the pores.[9]

Inorganic Precipitates

Sealing by double decomposition or other reactions, to precipitate sparingly soluble compounds in the anodic coating, is often used as a means of coloring the latter by means of metal oxides, sulphides, chromates and other compounds possessing better fastness to light and heat than organic dyestuffs.[10] Unfortunately, the range of colors so obtained is limited, and the brilliant tones of infinite variety obtained by means of organic dyestuffs are not possible. Thus, Prussian blue, lead chromate and cobalt oxides are the main colored precipitates used, but white precipitates, such as barium sulphate, have also been suggested as a means for producing opaque coatings.[11] Precipitates such as sparingly soluble metal chromates are of value for improving corrosion resistance,[12] but the higher concentration of chromate obtained by simple impregnation with highly soluble chromate or dichromate renders the former method of secondary importance for sealing aluminum anodic oxide coatings.

Organic Materials

The use of oils, greases, waxes, resins, varnishes and paints for sealing anodic oxide coatings is widespread and is capable of infinite variation in view of the large and growing number of such materials available.

Many other sealing treatments have been suggested, but those already discussed are the most widely used. An important function of all sealing treatments is the enhanced corrosion resistance imparted to the coating, but only sparse information is available on this aspect of the subject, and published data are lacking from which a comparison can be made of the protective value of various sealing treatments. The present work represents an attempt partly to fill the gap, and is confined to a comparison of the corrosion resistance of anodic oxide coatings subjected to various inorganic sealing treatments. Owing to the wide variation possible in organic sealing treatments, none of the latter has been included in this investigation.

Test Procedure

Material

Aluminum and many of its alloys are highly resistant to corrosion, even without protective treatment, and after anodic oxidation such materials resist corrosion by sea-water or sodium chloride solutions for prolonged periods. In order to obtain a measure of comparison in reasonable time the present tests were consequently made with an aluminum-base alloy relatively susceptible to corrosion by sodium chloride solution, i.e., a fully heat-treated Duralumin-type alloy of nominal composition 3.5 to 4.8 per cent copper, 0.3 to 0.6 per cent magnesium, 0.5 to 1.5 per cent silicon, 1.0 per cent (max.) iron, 1.2 per cent (max.) manganese, remainder aluminum.

The above alloy was used in the form of panels 2 x 10½ inches (.028" gauge) the surface area hence being 42 square inches.

Anodic Treatment

The panels were cleaned by means of the chromic-sulphuric acid pickle and were anodized by the sulphuric acid process using as electrolyte 22 per cent by volume of sulphuric acid, s.g., 1.84, at a temperature of 20°C± 2°C. The electrolyte was agitated by compressed air, and the voltage was raised rapidly to 12.5 and maintained at this level for 30 minutes, when the panels were removed and thoroughly rinsed in cold water in preparation for the various sealing treatments described later.

For comparison purposes panels were also anodized by the chromic acid process using the normal voltage cycle of from 0 to 40, in steps of 5 volts during the first 10 minutes, maintained at 40 volts for the next 20 minutes, increased to 50 volts during the next five minutes and maintained at 50 volts for a further five minutes, which completed the cycle. These specimens were rinsed and dried and not subjected to any sealing treatment.

Sealing Treatments

The types of sealing treatments used, together with details of the time of immersion and the analysis of the solutions are as follows:—

1. Sealing by Hot Water—The anodized panels were immersed in boiling water for 30 minutes.

2. Sealing by Salts of Weak Metallic Base—The anodized panels were immersed in boiling 2 per cent solutions of nickel acetate or cobalt acetate for 30 minutes.

3. Sealing by Dichromate—(a) Normal Process. The anodized panels were immersed for 30 minutes in a 5 per cent solution of potassium dichromate at boiling point. (b) Rapid Process. The anodized panels were immersed for 4 minutes only in solutions at 90°C containing (1) 100 gm potassium dichromate, 18 gm anhydrous sodium carbonate and 1L of water; (2) 15 gm potassium dichromate, 4 gm anhydrous sodium carbonate, and 1L. of water.

The above two solutions were made according to the recommendations of *Tomashov and Tyukina*[6] for rapid sealing in dichromate solutions of increased pH and possessed pH's by glass electrode at laboratory temperature of 6.81 and 7.40 respectively.

4. Sealing by Sodium Silicates—In order to compare the relative values of sodium silicates of different Na_2O/SiO_2 ratios for sealing, anodized panels were immersed for 30 minutes in boiling solutions each containing 5 per cent by weight of sodium silicates shown in Table I.

In addition, a further set of anodized panels was subjected to cold silicate sealing treatment by preliminary immersion for 15 minutes in a 5 per cent solution at laboratory temperature of the Q79 (see Table I) grade of sodium silicate, followed by immersion for 15

Table I

SODIUM SILICATE SOLUTIONS

Ref.	Molecular ratio SiO_2 to Na_2O	Reaction	Per cent water
Meta-silicate	1 : 1	Alkaline	nil
C100	2.05 : 1	,,	45.1
J81	2.65 : 1	,,	62.8
L100	2.9 : 1	,,	55.3
M75	3.0 : 1	Neutral	64.2
P84	3.3 : 1	,,	60.3
Q79	3.4 : 1	,,	62.0

minutes in a 2 per cent solution of acetic acid, also at laboratory temperature. Such treatment was given with the object of precipitating hydrated silica in the pores of the anodic coating.[9]

5. Sealing by Inorganic Precipitates—Apart from "hydrolysis sealing" by metal hydroxides, as already described, experiments were made by sealing with zinc chromate precipitated in the pores of the anodic oxide coating by a double decomposition reaction.[12] The anodized panels were treated by either Process A, immersion for 15 minutes in a boiling 5 per cent solution of potassium dichromate followed, after rinsing, by immersion for 15 minutes in a boiling 2 per cent solution of zinc nitrate; or Process B, the reverse of the above procedure, i.e., immersion in the zinc salt solution, followed by immersion in the dichromate solution.

Corrosion Test

The panels after treatment as above were weighed and then freely suspended vertically by P.V.C. cord in a closed chamber containing mist from a 3 per cent solution of sodium chloride, the condensate from which was run to waste. The mist was generated for 8 hours daily by compressed air and ebonite atomizers, the sodium chloride solution being gravity fed to the latter; for the remaining 16 hours of each 24 hours the mist was not generated but the panels remained wet from the high humidity already present.

At the conclusion of the test the panels were removed, photographed, cleaned by immersion in concentrated nitric acid at room temperature, reweighed, cut into standard size tensile test-pieces and their ultimate tensile strength and percentage elongation determined.

The un-coated test-pieces and the anodized test-pieces exposed without sealing and sealed by sodium metasilicate solution, suffered a relatively high rate of attack and these were removed from the salt spray after 57 days' exposure, the remaining panels being exposed for 509 days.

The losses of weight of the panels and the results of the tensile tests are recorded in Table II.

Table II

INFLUENCE OF VARIOUS SEALING TREATMENTS ON TENSILE PROPERTIES AND LOSSES OF WEIGHT AFTER SALT SPRAY EXPOSURE

Treatment	Ref. No.	Exposure (days)	U.T.S. tons/in.²		Percentage Elongation (on a 2 in. g.l.)		Losses of weight		
			Individual	Mean	Individual	Mean	gm	Mean gm	Mean mg/dm² day
None	Blanks	none	31.5 30.5 31.0	31.0	8.0 9.0 11.0	9.3	—	—	—
None (Blanks)	1A 1B 1C	57 57 57	21.65 20.70 20.75	21.03	nil nil 0.5	0.2	2.487 2.641 2.318	2.482	15.78
Anodized in chromic acid (D.T.D.910B)	2A 2B 2C	509 509 509	22.8 22.1 18.2	21.0	2.0 1.5 2.0	1.8	3.450 3.398 4.200	3.683	2.62
Anodized in sulphuric acid (D.T.D.910B) (SA); not sealed	3A 3B 3C	57 57 57	25.62 24.65 25.23	25.17	1.0 0.5 0.75	0.75	0.855 0.956 0.802	0.871	5.54
SA; sealed boiling water	4A 4B 4C	509 509 509	17.7 21.3 18.6	19.2	1.0 0.5 2.0	1.2	2.303 1.981 2.022	2.102	1.50
SA; sealed potassium dichromate (normal process)	5A 5B 5C	509 509 509	30.3 30.3 30.8	30.5	7.0 8.0 9.0	8.0	nil nil 0.002	less than 0.001	Trace
SA; sealed potassium dichromate (rapid process 1)	19A 19B 19C	509 509 509	29.2 30.5 30.5	30.1	7.0 7.5 6.0	6.8	0.011 nil 0.008	0.006	Trace
SA; sealed potassium dichromate (rapid process 2)	20A 20B 20C	509 509 509	30.7 30.7 29.5	30.3	9.5 7.5 6.5	7.8	nil nil nil	nil	nil
SA; sealed zinc chromate (Process A)	6A 6B 6C	509 509 509	31.1 29.9 30.3	30.4	8.5 8.5 6.5	7.8	0.017 0.007 0.010	0.011	Trace
SA; sealed zinc chromate (Process B)	7A 7B 7C	509 509 509	29.7 30.1 30.3	30.0	7.5 7.5 9.5	8.2	nil nil 0.002	less than 0.001	Trace
SA; sealed cobalt acetate	17A 17B 17C	509 509 509	30.1 * 30.6	30.3	10.5 * 9.5	10.0	0.503 0.620 0.631	0.585	0.42
SA; sealed nickel acetate	18A 18B 18C	509 509 509	29.7 30.0 29.9	29.9	9.0 9.0 9.5	9.2	0.331 0.974 0.386	0.564	0.40
SA; sealed sodium metasilicate $Na_2O : SiO_2 :: 1 : 1$	8A 8B 8C	57 57 57	19.95 20.42 19.37	19.9	0.5 0.75 0.5	0.6	2.077 2.153 2.381	2.204	14.01
SA; sealed sodium silicate C100 $Na_2O : SiO_2 :: 1 : 2.05$	10A 10B 10C	509 509 509	23.1 2.0 9.1	11.4	1.0 nil nil	0.3	4.014 11.014 5.708	6.912	4.92
SA; sealed sodium silicate J81 $Na_2O : SiO_2 :: 1 : 2.65$	11A 11B 11C	509 509 509	30.3 30.4 30.6	30.4	8.0 9.5 11.0	9.8	0.828 0.624 0.523	0.658	0.47
SA; sealed sodium silicate L100 $Na_2O : SiO_2 :: 1 : 2.9$	12A 12B 12C	509 509 509	25.2 25.9 29.3	26.8	3.0 3.5 6.5	4.3	0.642 0.593 0.551	0.595	0.42
SA; sealed sodium silicate M75 $Na_2O : SiO_2 :: 1 : 3.0$	13A 13B 13C	509 509 509	28.7 29.3 30.3	29.4	7.5 4.5 7.0	6.3	0.967 0.823 0.602	0.797	0.57
SA; sealed sodium silicate P84 $Na_2O : SiO_2 :: 1 : 3.3$	14A 14B 14C	509 509 509	30.5 29.8 31.0	30.4	9.5 5.5 11.0	8.7	0.564 0.643 0.520	0.576	0.41
SA; sealed sodium silicate Q79 $Na_2O : SiO_2 :: 1 : 3.4$	15A 15B 15C	509 509 509	30.1 30.4 31.0	30.5	7.0 6.5 7.5	7.0	0.697 0.658 1.210	0.855	0.61
SA; sealed cold sodium silicate Q79 followed by acetic acid	16A 16B 16C	509 509 509	6.1 7.8 1.1	5.0	1.0 nil nil	0.3	15.435 8.882 9.908	11.408	8.12

* *Broke across a corrosion pit*

Discussion

Under the conditions of the present tests the degree of corrosion protection resulting from a sealed anodic oxide coating is spectacular, the unprotected metal showing a loss of weight of nearly 16 mg/dm²/day compared with an undetectable loss of weight for some of the specimens protected by sealed anodic oxide coatings.

The chromic acid process provides good protection compared with that resulting from unsealed sulphuric acid anodized coatings, but when the latter are sealed, even by boiling water, their protective value is almost twice that of chromic acid anodized coatings; with some other sealing treatments, notably those involving chromate or dichromate, the protective value of sulphuric acid anodized coatings is increased still further, no visible corrosion being

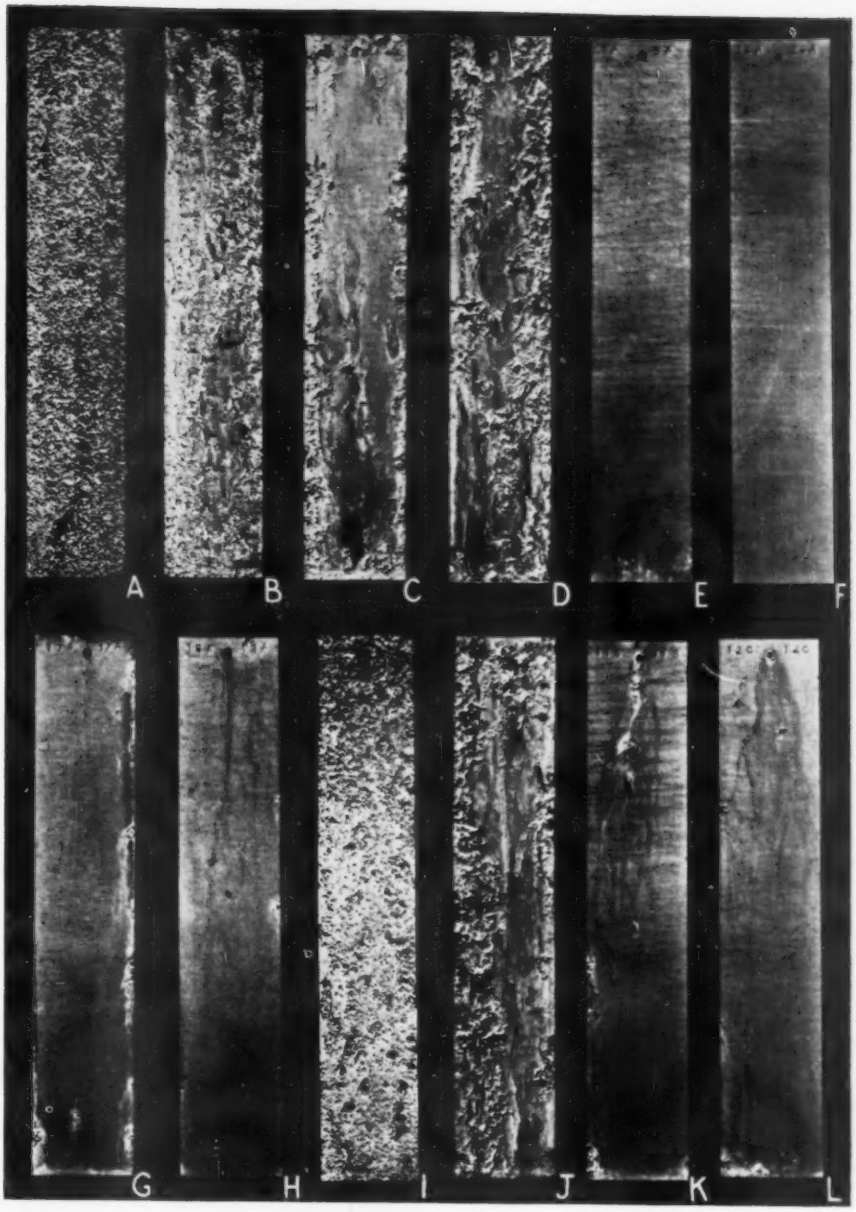
evident at the conclusion of the test.

The high efficiency of potassium dichromate sealed coatings is not changed by the substitution for the 30 minute process of the 4 minute rapid process of increased pH of Tomashov and Tyukina.[6] Excellent results are also obtained by zinc chromate impregnation[12] irrespective of whether the dichromate immersion of the coating follows immersion in the soluble zinc salt or vice versa. In the latter procedure a mechanism of straight dichromate sealing independent of the zic salt cannot be overlooked.

Sealing by cobalt or nickel acetate solution did not reveal any marked difference in efficiency between the two salts, both solutions being considerably more effective than boiling water, but less effective than dichromate sealing.

It has been suggested that the presence of nickel or cobalt hydroxide in anodic oxide coatings may reduce the protective value of the latter against corrosion. The results of the present tests provide no support for this hypothesis since, although the nickel and cobalt salt sealing treatments were deliberately prolonged to double the time normally given commercially, the protective values of the resulting coatings were of a much higher order than those resulting from their straight hydration by boiling water.

The experiments on sealing with sodium silicate solutions have shown that the latter can be equal in value to nickel or cobalt acetate solutions, but the silicate used should apparently possess a molecular ratio of SiO_2 to Na_2O of not less than 2.65 : 1. Thus, the total corrosion suffered by anodized panels sealed with a solution of sodium silicate of 2.65 : 1 SiO_2 to Na_2O ratio was less than 1/10th that of similar panels sealed by a solution of sodium silicate of 2.05 : 1 ratio of SiO_2 to Na_2O and some 1/30th that of panels sealed by a solution of sodium metasilicate and exposed to the corrosion test for a much shorter time. The poor results of the latter solution for sealing are to be expected, since it is sufficiently alkaline to attack both the anodic coating and the underlying metal and such attack was readily apparent immediately after the sealing treatment. Slight attack was also evident as a somewhat rough, patchy coating after sealing by the C100 sodium silicate solution, but silicates with SiO_2 to Na_2O molecular ratios of 2.65 : 1 and greater, showed no reaction with, or breakdown of, the anodic coating.



A—Not anodized; B—Sulphuric acid anodic coating (SA), not sealed; C—SA, boiling water sealed; D—Chromic acid anodic coating; E—SA, sealed dichromate; F—As E, rapid process; G—SA, sealed cobalt acetate; H—SA, sealed nickel acetate; I—SA, sealed sodium metasilicate; J—SA, sealed C100 sodium silicate; K—SA, sealed J81 sodium silicate; L—SA, sealed L100 sodium silicate. A, B and I = 57 days' salt spray; remainder 509 days' salt spray.

Fig. 1—Influence of sealing treatments on the protective value of anodic oxide coatings.

It will be observed that the best results were yielded by the P84 grade of sodium silicate, of molecular ratio of SiO_2 to Na_2O of 3.3 : 1; an increase in this ratio to 3.4 : 1 somewhat reduced the protective value of the sealed coating.

The mechanism of sealing by soluble silicate is not clear. The results show that reactions other than hydration must occur since the degree of protection given is considerably greater than that resulting from sealing by boiling water, and it is probable, therefore, that some aluminum silicate is formed together with precipitated silicic acid. Thus, hydration of the oxide may first occur followed by the formation of aluminum silicates, since *Ordway* showed that aluminum hydroxide changes slowly at room temperature to aluminum silicate on suspension in sodium silicate solution.[13] At the same time it is known that the anodic oxide coatings retain adsorbed

aluminum sulphate and sulphuric acid, and aluminum silicate may hence be formed by double decomposition, with silicic acid concurrently precipitated by the coagulating action of the acid and of the tri-and divalent ions present in the coating. The fact that alkali-metal silicate solutions behave as colloids which are flocculated by electrolytes has been noted by many workers, including *Hennis*[14].

An attempt to simplify sealing by immersing the anodized panels in a solution of sodium silicate at room temperature followed by coagulation of the silicate by immersion of the impregnated coatings in acetic acid solution,[9] was not successful, the results comparing most unfavorably with those of unsealed coatings. It is evident that room temperature treatment did not even hydrate the coating effectively, and the subsequent immersion in acetic acid solution probably produced no coagulation of silicic acid. This result could be anticipated in view of the known behaviour of alkali-metal silicate solutions in presence of acid, the amount of coagulation being reduced as the concentration of silicate is reduced. Thus *Doveri*[15] showed that a potash water-glass solution of s.g 1.20 precipitated silicic acid on adding excess of acid, but no precipitate occurred with a solution of s.g. 1.029, even on long standing.

In general, the best of the sodium silicate sealing treatments gave a protective value of the same order of efficiency as that resulting from sealing in nickel or cobalt acetate solutions, i.e., considerably better than that resulting from boiling water but of a lower order of efficiency than that resulting from solutions involving dichromate. The latter treatments produce yellow coatings and for applications where highly corrosion-resistant colorless coatings are desirable nickel or cobalt acetate or sodium silicate sealing should, therefore, be adopted in preference to boiling water.

Porous castings after sulphuric acid anodizing and sealing in boiling water often developed corrosion spots, particularly if stored in atmospheres of high humidity. Tests in atmospheres of 95 per cent relative humidity have shown that dichromate sealing prevents such corrosion and this treatment can be applied effectively to many dyed coatings, particularly those of saturated colors, without affecting the latter. In some cases, however, the dichromate causes a color change and nickel or cobalt acetate should then be used.

Figure 1 illustrates the appearance of the corrosion test panels after being sealed by many of the methods discussed.

The author's thanks are due to the directors of High Duty Alloys, Ltd., for permission to publish this Paper. Thanks are also due to Mr. V. F. Henley, B.Sc., F.R.I.C., of Alumilite and Alzak, Ltd., for helpful criticism.

References

1. T. Rummel, *Zeit. Phys.*, 1936, *99*, 518; W. Baumann, *Ibid.*, 1939, *111*, No. 11-12. Electron microscope studies have been made by H. Mahl, *Korr. Metall*, 1941, *17*, No. 1.
2. *Vide* the electron diffraction studies of R. Harrington and H. Nelson, *Metals Technology*, Feb., 1940, Tech. Publn, 1158.
3. Aluminum Colors, Inc., Brit. Pats., 406,988 (1932), 407,457 (1932).
4. Aluminum Colors, Inc., Brit. Pat., 413,814 (1932)
5. R. S. Dunham, Brit. Pat., 393,996 (1931); J. D. Edwards, U. S. Pat., 1,946,152 (1933).
6. N. D. Tomashov and M. N. Tyukina, *Bull. Acad. Sci., U.S.S.R.* (Chem. Sci. Sect.), 1944, No. 5. Translation in *Light Metals*, 1946, *9*, No. 96, 22; also *Chemical Abstracts*, 1947, *41*, 4723.
7. R. S. Dunham, *loc. cit.*
8. J. D. Edwards, U. S. Pat., 1,946,153 (1933).
9. A. Jenny, "The Anodic Oxidation of Aluminium and Its Alloys," p. 205. Translation by W. Lewis, Griffin and Co., Ltd., London, 1940.
10. R. S. Dunham, Brit. Pat., 391,903 (1931); Aluminum Colors, Inc., Brit. Pat., 401,270 (1932).
11. C. H. R. Gower and E. Windsor-Bowen, Brit. Pat., 412,205 (1932).
12. High Duty Alloys, Ltd., and L. Whitby, Brit. Pat., 570,054.
13. J. M. Ordway, *Amer. J. Sci.*, 1916, *32*, 153, 340.
14. W. Hennis, "Ueber die Reaktion Zwischen Alkalisilikaten und Schwermetallsalzen," Erlangen, 1906.
15. L. Doveri, *Ann Chem. Phys.*, 1922, *21*, 40.

Shop Problems

Abrasive Methods—Surface Treatments—Control
Electroplating—Cleaning—Pickling—Testing

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Designing Auxiliary Anodes for Chrome Plating

Question: Can you tell me where I can get detailed information on how to design auxiliary anodes for producing a uniform chrome plating on various parts?

S. C. S.

Answer: Each individual part presents different problems for auxiliary anodes, and the best design is arrived at through trial. One of the most helpful books we have seen on this subject is the "Plating Rack Manual," published by the Belke Mfg. Co., 947 N. Cicero Ave., Chicago 51, Ill. This volume shows many special arrangements that can be used, and furnishes helpful information that can be used as a guide in designing special racks and anodes. The price of this book is $5.00, and it may be obtained from the above firm.

Coloring Steel Yellow and Black

Question: We are interested in producing black and yellow colors on steel. Can you supply formula for doing this work?

J. G. G.

Answer: There are a number of commercial materials available for blackening steels by immersion in a hot solution. Names of firms who can furnish these materials are being sent to you.

For producing a yellow color, the only method we know of is by heat tinting. The parts are enclosed in an oven and the parts heated uniformly to a temperature in the range of 475°F. (The exact temp. will have to be worked out by trial). This produces a temper color that will be a straw yellow, changing in time to a darker yellow, then to other shades. The process would have to be accurately controlled. Of course, the steel parts could be brass plated with a good yellow brass deposit, which would give you a coating that has much better resistance to corrosion and abrasion.

Tank Linings for Hydrofluoric Acid Baths

Question: We have had considerable difficulty in finding a tank or tank lining material that will stand up for any length of time when hydrofluoric-nitric acid solutions are put in it. Do you know of a material that would be suitable for this type of service?

R. J. Y.

Answer: Several materials have been developed in recent years for resisting corrosion by a mixture of nitric and hydrofluoric acids. Satisfactory choice of these materials depends greatly on the actual concentrations and temperatures involved, and it is best to have the recommendations of a reputable supplier of the materials before making an installation. Under separate cover we are sending you a list of firms who can recommend the most suitable material for your specific use.

Blackening of Silver

Question: We are searching for a bath that will blacken silver by immersion at room temperature. We are familiar with several of the baths that require heating, but for special reasons want one that works at room temperature.

H. M. I.

Answer: Practically all of the baths recommended for blackening silver are used at elevated temperatures, as this speeds up the process. Many of these will also work cold, but the process takes very much longer, and in some cases the same deep black is difficult to produce. You might try using moist hydrogen sulfide gas, which would be a room temperature method. The parts should be placed in a closed chamber, and hydrogen sulfide gas which has been bubbled thru water is led into the chamber for a time sufficient to produce the black silver sulfide coating.

Poor Adherence of Chrome Over Nickel

Question: We occasionally have trouble with our chrome plate not adhering to our buffed nickel work. We have tried a soak cleaner after buffing but that does not seem to help. Can you suggest a remedy for this problem?

R. K. P.

Answer: The problem you are having is probably due to the nickel plating becoming "passive" during the buffing operation. This can be eliminated and the nickel rendered active again by introducing a 5% hydrochloric acid dip into your cycle before chrome plating, following the usual degreasing and cleaning steps. Another solution that will de-passivate nickel is a reverse current treatment for a few seconds in a 10% Sodium Cyanide bath.

Removing Magnetism from Nickel Plating

Question: We do plating on ship binnacles, and find that after chromium plating the parts have a permanent magnetic field that affects the compass. Our cycle is as follows: Polish to a high finish, nickel plate in a cold solution, buff bright, and chrome plate. Can you tell us how to eliminate this problem?

J. B.

Answer: There are two possible

causes for your trouble. Inasmuch as you do not state whether the base metal is steel or not, it is possible that the parts are becoming magnetized (if made of steel) during the processing. Another possibility is that the permanet magnetic effect is coming from the nickel plating. Nickel is a magnetic material and could affect the compass if present in large enough amounts. The best way to demagnetize both the steel and the nickel would be to subject the parts to an alternating current field that can be made up of many turns of copper wire large enough to form a loop for the parts to be passed thru. Your electrician should be able to make up such a coil in a few minutes.

Removing Heat Treat Scale from Stainless Steel

Question: Do you know of any other baths than those containing hydrofluoric acid for the descaling of heat treated stainless steel? We would like to avoid using this acid if possible.

P. F. D.

Answer: A bath that is widely used for descaling stainless steel is as follows:

Sulfuric acid . . 9-10 parts by volume
Salt (NaCl) . . ¼ lb./gal.
Water . . . . . to make 100 parts.
Temp. 140-160°F.
Time 10-90 mins.

An alternate treatment that utilizes a very weak hydrofluoric acid bath, which should cause no trouble, is as follows:

a) Treat the parts in a 10-12% sulfuric acid bath containing a good inhibitor at 170°F for 6 mins. Rinse well.
b) Transfer the parts to a bath made up as follows:

Sodium Hydroxide . . . . 12-14% by wt.
Potass. Permanganate . . 5- 6% by wt.
Temp. 170-180°F. Time 20-30 mins.
Rinse.

c) Immerse in solution (a) again for 5 mins.
d) Immerse in 8% Nitric acid plus 1% hydrofluoric acid at room temp. for 10 mins. Rinse well.

Electropolishing Silver

Question: Can you give us any details on the new process for electropolishing silver that we have heard is being used in some plants?

E. N.

Answer: The process you mention was the subject of an article in the May 1947 issue of *Metal Finishing*, and is a patented process of Oneida, Ltd. (U. S. Patent 2416294). Briefly, the details are as follows:

The parts are transferred from the silver plating bath, without rinsing, and made anodic in a bath made up of:

Metallic Silver (as $KAg(CN)_2$) . . . . . 4-6 troy oz.
Potassium Cyanide . . . . . 4-5 oz./gal.
Potassium Carbonate . . . 6-8 oz./gal.

The operating details are:
Voltage 2.7-3.5
Cathodes . . . . . Pure Silver
Anode-Cathode Ratio 1:2
Current Density . . 12-18 amps./sq. ft.

Rough Copper Deposits

Question: We are having trouble with our copper deposits plating out very rough. The solution analysis seems to be all right. Would a little Caustic Soda smooth it out?

L. V. T.

Answer: Your rough deposits are no doubt due to solid particles in the bath. The solution should be thoroughly filtered to get rid of any soluble matter. If this does not eliminate the difficulty, it is possible that you are plating at too high a current density. A recent paper presented at the AES Technical Sessions at Atlantic City described a diaphragm tank construction that eliminated roughness in copper deposits, and you might find this procedure to be what you need in your operations also. While caustic soda is used in some cyanide copper baths, it would be best to try these other methods of correction before adding another constituent to the bath.

Surface Areas of Standard Machine Screws

The following table will be found useful for barrel plating computations on commercial machine screws.

Commercial Size	Thread Dim.	Total Area per inch of Thread	Area of Round Head	Area of Flat Head
0-80	.060-80	.286 in²	.028 in²	.023 in²
1-70	.074-70	.354 "	.042 "	.036 "
2-64	.089-64	.434 "	.061 "	.051 "
2-56	.089-56	.427 "	.061 "	.051 "
3-50	.101-50	.484 "	.080 "	.066 "
4-32	.113-32	.510 "	.100 "	.089 "
4-36	.113-36	.522 "	.100 "	.089 "
4-48	.113-48	.549 "	.100 "	.089 "
5-40	.125-40	.599 "	.125 "	.108 "
5-50	.125-50	.617 "	.125 "	.108 "
6-32	.141-32	.660 "	.154 "	.138 "
6-40	.141-40	.686 "	.154 "	.138 "
6-48	.141-48	.701 "	.154 "	.138 "
7-40	.154-40	.758 "	.185 "	.167 "
8-32	.166-32	.801 "	.219 "	.198 "
8-40	.166-40	.823 "	.219 "	.198 "
10-24	.194-24	.918 "	.291 "	.270 "
10-32	.194-32	.955 "	.291 "	.270 "
10-40	.194-40	.977 "	.291 "	.270 "
10-48	.194-48	.992 "	.291 "	.270 "
12-24	.221-24	1.066 "	.377 "	.350 "
12-30	.221-30	1.117 "	.377 "	.350 "
12-32	.221-32	1.124 "	.377 "	.350 "
12-40	.221-40	1.125 "	.377 "	.350 "
13-26	.234-26	1.150 "	.445 "	.411 "
14-20	.246-20	1.175 "	.478 "	.441 "
14-24	.246-24	1.205 "	.478 "	.441 "
14-32	.246-32	1.242 "	.478 "	.441 "
14-40	.246-40	1.264 "	.478 "	.441 "

EXAMPLE

To find the total plating area of a No. 10-40 round-head machine screw having a thread length of ¾ inches:

TOTAL AREA = Area of round head + (Thread length x Area per inch of thread)
= .291 + (.75 x .977) = 1.024 square inches

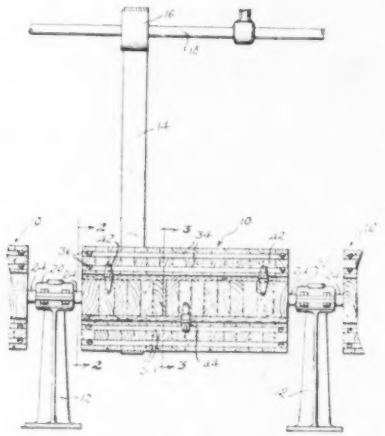
The areas given above for the heads include the area at the bottom of the screw threaded portion.

Patents

Wooden Tumbling Barrel

U. S. Patent 2,443,283. *Joseph N. Wallace.*

A tumbling barrel consisting of a plurality of wooden staves joined edge-



wise and disposed in parallel relation about a longitudinal axis, means supporting said barrel for rotation upon said longitudinal axis, said staves being assembled with the end grain of the wood radially disposed relative to the center of rotation of the barrel, and means for rotating said barrel, said staves being each composed of a plurality of blocks secured in sidewise alinement and a plurality of reinforcing means extending longitudinally of each stave and embedded in longitudinally extending external grooves therein.

Anion Exchange Resins

U. S. Patent 2,442,989. *Sidney Sussman, assignor to The Permutit Co.*

A process of treating an aqueous solution to effect an exchange of anions comprising contacting said solution with an anion exchange resin substantially insoluble in water, dilute acids and dilute alkalies and prepared by alkaline condensation of 0.7 to 5 mols of a free polyethylene polyamine with 2.5 to 6.6 mols of an aldehyde selected from the class consisting of formaldehyde, furfural and glucose and one mol of an organic compound selected from the class consisting of ketones and aldehydes, each member of said class having at least two methylol-forming hydrogen atoms.

Rust-Preventive Hydrocharbon Compositions

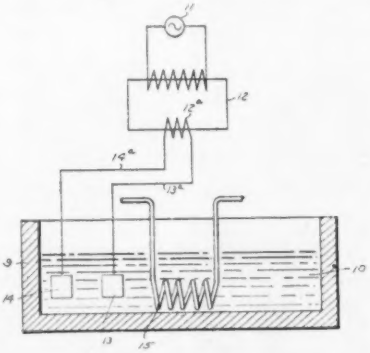
U. S. Patent 2,442,672. *George Hugo von Fuchs and Norman B. Wilson, assignors to Shell Development Co.*

Rust-preventive lubricating oil comprising predominantly a mineral lubricating oil containing dissolved .001% to .1% of a hydrogenated and hydrolyzed product of the reaction of an olefin with maleic acid anhydride and .001% to 1% of an alkyl phenol oxidation inhibitor, said product having at least 20 carbon atoms.

Electrolytic Polishing of Stainless Steel

U. S. Patent 2,442,592. *Alexander L. Feild, assignor to The American Rolling Mill Co.*

The art of electro-polishing a stainless steel product which comprises, immersing the product to be polished in a bath containing by volume 80%



or more of concentrated aqueous nitric acid (sp. gr. 1.40-1.42) and the remainder being water, and while maintaining the bath at a temperature below 25° C., passing only alternating current through said bath between the product and a cooperating electrode immersed therein, the current density being at least ½ amperes per square inch of product surface.

Cleaning of Metals

U. S. Patent 2,442,802. *Norman L. Evans, assignor to Imperial Chemical Industries, Ltd.*

A process for cleaning metals and metal articles which comprises immersing metals other than zinc and zinc alloys, or articles thereof, in a fused bath containing 1-10% by weight of alkali metal cyanide, 0.1-2.0% by weight of water, and the remainder principally alkali metal hydroxide, at a temperature of 300°-600° C. for between ½ and 30 minutes.

Recovery of Nickel from Idle Nickel Electroplating Baths

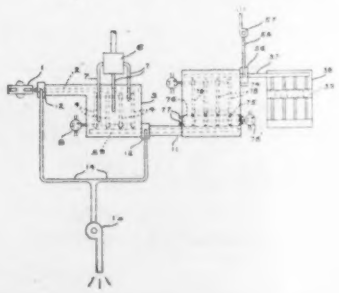
U. S. Patent 2,442,629. *Andrew Wesley, and Edward Judson Roehl, assignors to The International Nickel Co., Inc.*

A process for recovering nickel by electrodepositing a mass of iron and nickel from electroplating electrolytes without substantially replenishing the nickel from other sources as nickel is recovered which comprises passing an electric current between an anode of ferrous material substantially devoid of nickel and a cathode immersed in an aqueous nickel-containing electrolyte having a pH between about 4.0 and about 5.6, employing a current density of about 20 to about 35 amperes per square foot until the nickel content of the electrolyte is reduced to about 3 ounces per gallon without substantially replenishing the nickel from other sources as nickel is plated out of the electrolyte, thereafter employing a different current density of about 45 amperes per square foot without substantially replenishing the nickel of the electrolyte whereby the efficiency of nickel recovery is markedly increased and continuing the electro-deposition at said different current density until about 85% to about 90% of the nickel originally present in said aqueous electrolyte has been electro-deposited at the cathode as a nickel-iron deposit.

Method of Descaling and Coating Hot-Rolled Ferrous Metal

U. S. Patent 2,442,485. *Frederick C. Cook.*

The process of continuously placing a permanent tightly adhering metal coating the primary component of which is zinc on a hot rolled ferrous



metal body which has been heated red hot and nearly reduced to shape by hot rolling, the body during rolling being plastic and covered with brittle scale, comprising substantially descaling the hot ferrous metal body by a final heavy

pass through the rolls, said pass substantially elongating the ferrous metal body and breaking the brittle scale therefrom, passing the body immediately into a chamber containing hot deoxidizing gas, the residual heat in the body and the gas serving to completely remove all scale from the body so that the body present a sponge surface, enveloping the body with a coating metal comprising zinc, the residual heat causing the coating metal to alloy with and firmly adhere to the sponge surface of the ferrous metal body, and gradually cooling the body to maintain the coating metal thereon.

Process for Making Front-Surface Mirrors

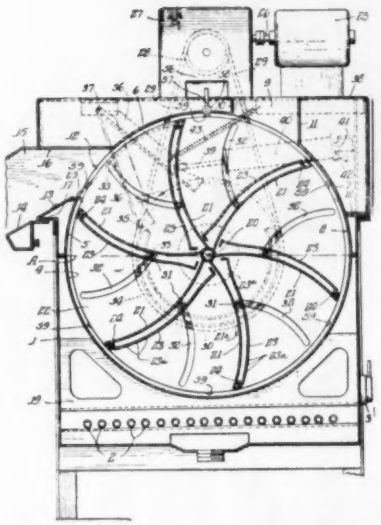
U. S. Patent 2,443,196. *Arnold Raines and Raymond W. Boydston and Allen J. Eshner.*

In the art of making optical mirrors, the technique which comprises cleaning the surface of a glass mirror blank by supporting it in a vacuum chamber, locating a removable electrically conductive article on said glass blank, evacuating said chamber, subjecting said glass blank to a high frequency electromagnetic field of such intensity and character as to induce in said blank dielectric and other losses which raise the blank's temperature and thereby impart heating thereto, thermally evaporating and condensing a first coating of aluminum upon said cleaned surface while in said vacuum, breaking said vacuum and gently rubbing and washing said first coating to remove all unadhered portions thereof from the glass blank, reforming the vacuum, and with the glass blank in the vacuum depositing a second coating of aluminum upon the so treated said first coating and upon all exposed areas of the blank therebeneath, whereby to form a reflecting film which is tenaciously adherent and completely continuous and which has no pinholes or breaks of any kind.

Treating Articles in a Liquid Bath

U. S. Patent 2,442,484. *John W. Chamberlin and John F. Horvath, assignors to Cleaver-Brooks Co.*

A material treating apparatus comprising, in combination, a tank for the treating liquid, a cylinder mounted in said tank with its axis substantially horizonal and with the lower portion

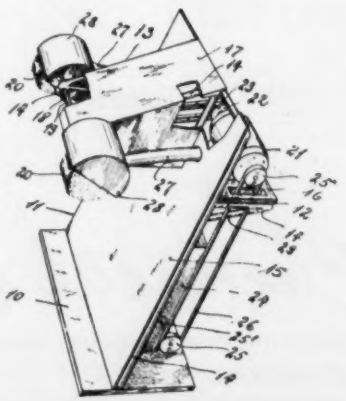


of the cylinder submerged in the liquid, a paddle wheel structure including a shaft journaled at the axis of said cylinder with paddles extending outwardly therefrom at angular intervals to form segmental pockets which are open upwardly to receive material at the upper side of the wheel and which serve to carry said material downwardly through the liquid at one side of the cylinder axis and then upwardly at the other side of said axis, the cylinder having a discharge opening, and said paddle wheel including ejectors each mounted to traverse one of the pockets for removing material therefrom, and means actuating each ejector when its pocket registers with said discharge opening.

Buffing or Polishing Machine

U. S. Patent 2,442,744. *Carl J. Geiger.*

As an article of manufacture, a buffing machine or the like, comprising a base plate, an upright plate wall mounted thereon, a horizontal platform projecting from the rear face of said wall, a motor mounted on said platform, adjacent to the rear face of said wall, a housing projecting centrally and forwardly from the upper part of the front face of said wall, a horizontal shaft extending parallel to said wall in the plane of the axis of said motor, and borne in the forward end of said housing, buffing wheels fixed on said shaft, one on each side of said housing, a motion transmitting means for said shaft from said motor, concealed within said housing, a dust collecting chamber mounted on said base plate at the rear of said wall below said platform, rotary means for creating suction in said chamber, means for transmitting motion to said suction creating means from said motor, shields mounted above said buffing wheels and conduits connected to and leading from within said shields through said wall into the dust collecting chamber.



Recovery of Nickel from Idle Nickel Electroplating Baths

U. S. Patent 2,442,628. *Andrew Wesley and Edward Judson Roehl, assignors to The International Nickel Co., Inc.*

A process for recovering nickel by electro-depositing a mass of iron and nickel from electro-plating electrolytes without substantially replenishing the nickel from other sources as nickel is recovered which comprises passing an electric current betwen an anode of ferrous material substantially devoid of nickel and a cathode immersed in an aqueous nickel-containing electrolyte having a pH between about 4.0 and about 5.6 employing a current density of about 20 to about 35 amperes per square foot until the nickel content of the electrolyte is reduced to about 3 ounces per gallon without substantially replenishing the nickel from other sources as nickel is plated out of the electrolyte, thereafter employing a different current density of about 5 amperes per square foot without substantially replenishing the nickel of the electrolyte whereby the efficiency of nickel recovery is markedly increased and continuing the electro-deposition at said different current density until about 85% to about 90% of the nickel originally present in said aqueous electrolyte has been electro-deposited at the cathode as a nickel-iron deposit.

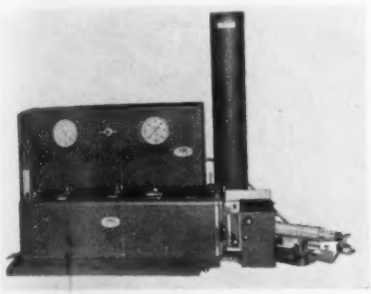
New Methods, Materials and Equipment for the Metal Finishing Industries

Recent Developments

Flame Spectrophotometer for Simplified Analytical Procedure

National Technical Laboratories, Dept. MF, South Pasadena, Calif.

A Beckman Flame Spectrophotometer has recently been announced by



National Technical Laboratories, manufacturers of Beckman pH Meters, Beckman Radiation Meters and other well-known Beckman instruments. The new unit greatly simplifies both qualitative and quantitative analyses of a large number of chemical elements, and its use of a hot flame is of particular value since it permits excitation of the spectral lines of a large number of elements, including many of the heavy metals and alkaline earths, whereas a cool flame instrument excites only those of the alkali metals. Its wide spectral range, covering the ultraviolet, visible and near infrared spectral regions, insures maximum range and versatility.

Samples are atomized and introduced at a uniform rate into a very hot oxygen and gas flame through a specially designed burner. The spectral emission lines of the elements are excited and the spectrophotometer isolates these lines and measures their intensities relative to a blank or standard.

Only small samples are required, and because the samples are atomized directly from external beakers, samples can be analyzed very rapidly. A rate of four samples per minute is easily maintained — and re-checks against blanks can be quickly made at any time. Results are instantly and directly readable on an accurately-calibrated dial. No photographic processes or densitometer comparisons are necessary.

The sample consumption rate is less than 0.2 cc per minute and complete analyses can be made on samples as small as 5 cc.

Further information on the Beckman Flame Spectrophotometer may be obtained by writing to the above address.

New Combination Alkali-Emulsion Cleaner

Northwest Chemical Co., Dept. MF, 9310 Roselawn Ave., Detroit 4, Mich.

A new type, low priced, combination Alkali-Emulsion Cleaner made up principally of plentiful materials is announced by the above firm for pressure washing equipment that will remove oils and tallow based drawing compounds. A petroleum derivative contained in Metal Cleaner SC-9 aids in controlling foam and the formation of rust. It is particularly adapted to general washing machine use, prior to bonderizing and painting and as a pre-cleaner prior to plating. Shipped in non-returnable steel drums and kegs. This is one of the thirty-five standard Northwest cleaning compounds including Electrolytic, Immersion, Solvent, Spray, and Water Wash types . . . the "Lo-Hi" pH process of chemically cleaning metals, preparatory to plating, porcelain enameling, etc., makes practical pH control regardless of the type of metal or soil, it is claimed.

Color Buffing Compositions

The Hanson-Van Winkle-Munning Co., Dept. MF, Matawan, New Jersey.

A new bar composition for color buffing carbon steel, stainless steel and chromium plate has been developed by the above firm. This composition is designated as 6-B-72.

In order to produce a good color on the above metals free from cloud or cast it is necessary that the compound produce a very light and soft face on the buff with sufficient lubrication to prevent scratching. Compositions producing this type of buff face have very limited cutting ability.

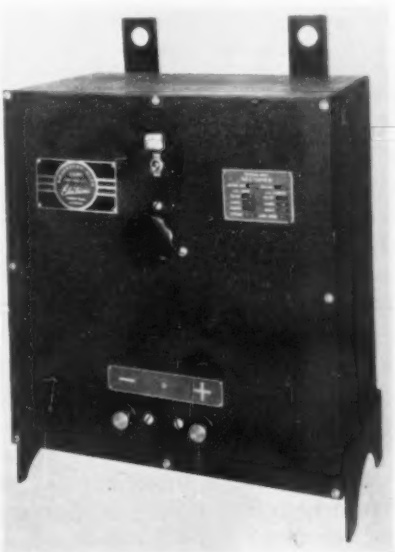
6-B-72 Composition has a binder that retains the abrasive on the buff face for a greater period of time permitting it to do its cutting and does not build up a heavy waxy face that prevents a high color free from casts, it is claimed.

6-B-72 produces a high finish on carbon and stainless steels and at the same time cuts out imperfections left from the cutting down operations. It also will rapidly cut and color burned chrome, according to the manufacturer.

Rectifier for Electrolytic Purification of Nickel Baths

Richardson-Allen Corp., Dept. MF, 15 W. 20th St., New York, N. Y.

For the first time, special units are being manufactured for the express



purpose of electrolytic purification of plating baths.

For continuous treatment the output of these units can be connected to a small auxiliary tank and pump. The solution is then being continually pumped to the auxiliary tank during working hours, purified, and pumped back to the main tank. For overnight or off working hours, this rectifier is connected to the main tank. The rectifier was developed primarily for the continuous 24-hour treatment of Bright Nickel Solutions.

Stepless controls permit any voltage control from 0 to 1 Volt. Models offered include 1 Volt—50 Amperes; 1 Volt—100 Amperes; 1 Volt—200 Amperes.

The units are small and compact. A unit with 1 Volt—50 Ampere rating, weighs 75 lbs. and measures 15 inches wide x 9 inches deep x 17 inches high.

Safety Floor Finish to Prevent Slipping

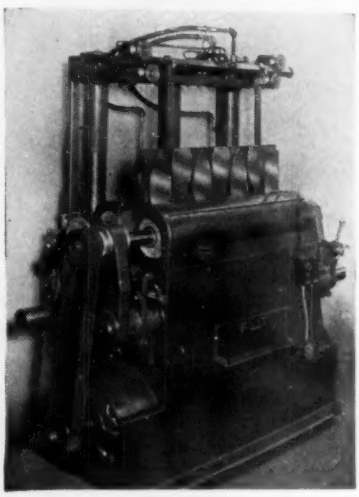
Industrial Safety Products Div., Watson-Standard Co., Dept. MF, 225 *Galveston Ave., Pittsburgh* 30, *Pa.*

Substantial progress in the elimination of one of the most common industrial accidents—slips and falls resulting from hazardous footing—is being accomplished by the increasing use of a new safety floor finish, Traffic-Tred, according to the above firm. This material is an abrasive floor coating which is applied like paint. It dries to a hard, rough surface with a texture much like coarse sandpaper. It works equally well on steel, wood or concrete, removing most of the danger from walking areas subject to dampness, greasiness and other slippery conditions, it is claimed.

Detailed information about Traffic-Tred can be obtained by writing to the above address.

Hydraulic Polisher and Glazing Machine

Central Machine Works, Dept. MF, Worcester 8, *Mass.*



Designated as Model 4, a new machine for mirror finishing and glazing of flat and near flat surfaces such as knives, flat iron bases, hack saw frames, machettes, skates, etc., has been designed by the above firm.

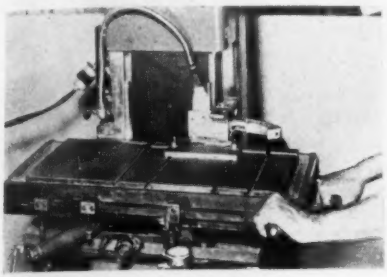
Based on an entirely new principle it is claimed to speed up the finishing of work on a large production scale. The work is mounted on a magnetic or non-magnetic holder with a vertical working stroke, the speed or length of which can be changed instantly. The work is allowed to drop between two buffing wheels. The machine allows for a 4" to 8" roll of buffs in a guarded chamber and pressure of rolls on work is adjusted automatically to accommodate all types of work. Loading can be accomplished from front or either end of machine which is one of its many safety features. Samples of work will be processed.

Precision Table for Belt Grinder

Porter-Cable Mach. Co., Dept. MF, Syracuse 8, N. Y.

An improved automatic feed table, the Model FT-9, is now available for the Porter-Cable Model BG-8 Wet Abrasive Belt Grinder. The redesigned table provides greater precision and a smoother approach for feeding work into the grit belt.

Any material may be ground and polished to a close tolerance, it is claimed. Simple inexpensive fixtures reduce cost and save loading time. The machine chamfers, rounds, squares,



forms radii, grinds flat and parallel surfaces.

Earlier models of the FT-9 Table used the same oil-coolant in the recirculating system as a hydraulic liquid for the feed table. Two separate systems have now been installed. Special coolants may be used for various materials, while the table is independently operated by a standard hydraulic oil.

In addition, a rod has been added to the former free piston, with a gland at the end of the cylinder oil shield, to assure smooth positive action at all times.

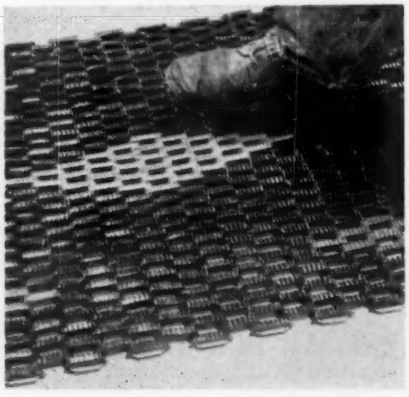
The Table automatically controls the pressure and rate of feed while a dial indicator shows rate of machining. A micrometer stop halts the operation, and can be reset instantly. Additional manual controls permit a wide variety of applications. "T" slots hold fixtures.

Hard Floor Fatigue and Slippery-Floor Hazards Eliminated

General Scientific Equip. Co., Dept. MF, 2700 W. Huntington St., Phila. 32, Pa.

Corrugated mats made of especially compounded rubber links woven on 12 gauge spring steel wire provide sure, comfortable footing to stop slipping accidents and reduce worker fatigue, it is claimed.

Akro-mats are particularly adapted for use where moisture, oils, animal



fats, acids, chemicals, solvents and abrasives are apt to be on the floor as the rubber resists deterioration. They are easy to clean and easy to handle, lay flat or roll up.

Recommended by leading safety engineers to increase efficiency, production and profits. Many plants are now using these mats for positive underfoot protection on walking surfaces, loading platforms, washroom floors, elevators, cat walks, ramps, landings, approaches, side walks, inclines, aisles and steps.

Economically priced, Akro-Mats are available in any desired length and in widths up to 48 inches.

Electric Airtowel for Drying Hands

Morici Products Corp., Dept. MF, 835 *W. Madison St., Chicago* 7, *Ill.*

The Electric Airtowel Hand Dryer gives instant hot air which dries the hands in approximately 40 seconds, it is claimed. Operates by means of a

sturdy foot switch mounted on a heavy steel platform. Contains a sturdy Universal motor with self-oiling bearings and a statically and dynamically balanced blower. Base constructed of finest material to insure trouble-free service and has a drain of 1000 watts 115 volts A.C.-D.C. The Airtowel is easy to install, and very inexpensive to operate, according to the firm.

Cartridge Water Demineralizer

A. E. Tomkin & Company, Dept. MF, P. O. Box 7311, *Washington* 4, D. C.

By the use of the cartridge Water Demineralizer, every metal finishing shop can have pure water always available with a convenience as turning on the water tap, it is claimed. The low cost of pure water and the convenience of having pure water at hand makes this development an important adjunct for metal finishing work.

The Cartridge Demineralizer produces mineral-free water by the passage of any water through a column of ion-exchange resins. No regeneration of the resin beds are involved since the Unit operates with throw-away cartridges. An electronic indicator shows the quality of the converted water at all times. No special skills are needed.

Further information and literature may be obtained by writing on company letterhead.

Heavy Duty Industrial Rectifiers

Industrial Electronics & Transformer Co., Dept. MF, 1801 *E. Slauson Ave., Los Angeles, Calif.*

This firm announces a complete line of time tested regulated rectifiers for

heavy duty industrial applications. Offered for the first time is a fully-regulated rectifier with *either* electronic control for extremely fast response or magnetic amplifier control for vacuum tube elimination. Both types are fully automatic with no moving parts.

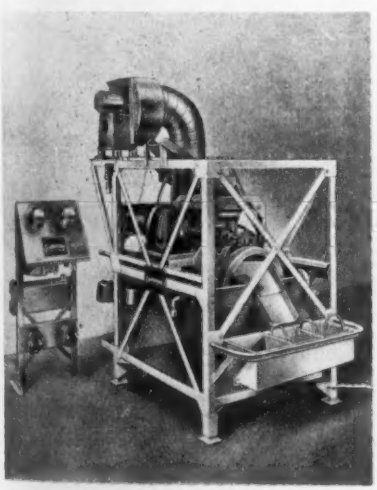
Standard models offer current ranges from 5 to 10,000 amperes and voltage ranges from 10 to 500 volts. Voltage regulation is obtainable to plus or minus ½ of 1% from no load to full load with a 10% change in supply line voltage, according to the firm. D.C. ripple may be reduced to 1/100 of 1%. Recovery time under severe load changes is only a fraction of a second, it is claimed.

The extreme dependability and maintenance-free operation of this equipment has resulted in wide industrial acceptance. Regulated rectifiers are now being used for motion picture sound systems; automatic unattended battery chargers; large, automatic platers; aircraft ground power, and as central D.C. power system supplies.

Chromium Plating Barrel

R. Cruickshank Ltd., Dept. MF, Camden St., Birmingham 1, *England.*

A new folder just published by this firm describes their equipment for barrel plating small parts in chromium. In operation, the work is placed in a hopper from where it is automatically



carried thru the plating bath by the rotation of the barrel, lifted out of the solution and deposited in pans where the excess plating solution drains off and can be returned to the main bath. Parts are then ready for final rinsing and drying. Total plating cycle is 3½ mins. Provision is made for heating

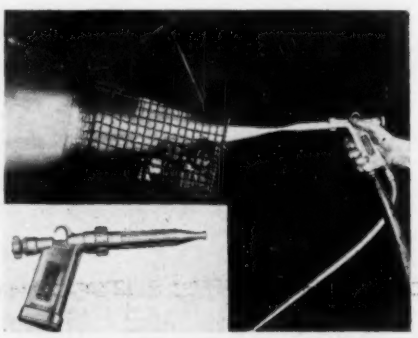
and cooling the bath, and the equipment has a self contained exhaust connection and fan. The capacity of the unit shown is approximately 40-50 lbs. of work per hour.

New Pressure Washer Utilizes Cold Steam Principle

D. & M. Products, Inc., Dept. MF, 4655 Kingswell Ave., Los Angeles 27, Calif.

An improved pressure washer, the Hydro-Air, with a broad range of applications to industrial cleaning jobs, has been announced by the above firm.

Using a precisely controlled mixture of water and compressed air, the Hydro-Air produces a blast of "cold steam" that penetrates and cleans without back splash or harm to finish. Its effectiveness has been proved in the automotive field in such difficult applications as the cleaning of motors, chassis, transmissions and other parts.



The Hydro-Air pressure washer will effect a saving of time and labor in metal processing, maintenance and repair and degreasing or paint stripping departments, it is claimed. Through the use of varying adjustments, the washer can remove heavy dirt and grease or quickly and thoroughly rinse cleaning solvent from sheets and parts.

In aviation, the Hydro-Air washer can effectively clean engines, landing gear and plane surfaces after the correct solvents have been applied.

Virtually any industry in which there exists a problem of cleaning raw materials, equipment or parts will find time-and-labor saving applications for the Hydro-Air pressure washer.

Rubber Insulated Wire for Resistance to Water

United States Rubber Co., Dept MF, Rockefeller Center, New York, N. Y.

A new electrical wire with rubber insulation that improves when soaked in water has been developed by the above firm.

The new wire is designed for use underground and in wet locations where high moisture resistance gives it longer life and increased safety.

Secret of the wire's durability is a coating of high purity natural rubber latex applied by the dip process. Tests conducted by *Underwriters' Laboratories, Inc.*, where the wire was immersed in water at a temperature of 122 degrees Fahrenheit for twenty-four weeks, showed an insulation resistance curve that rose from 500 megohms to 2,400 megohms per 1,000 feet of wire. A normal insulation resistance curve shows a sharp drop after two to four weeks immersion. In addition to greater moisture resistance, the insulation of the new wire has improved tensile strength and elongation. It is being marketed under the trade name "Laytex RUW."

Rubber-Coated Gloves for Women's Hands

Edmont Mfg. Co., Dept. MF, Coshocton, Ohio.

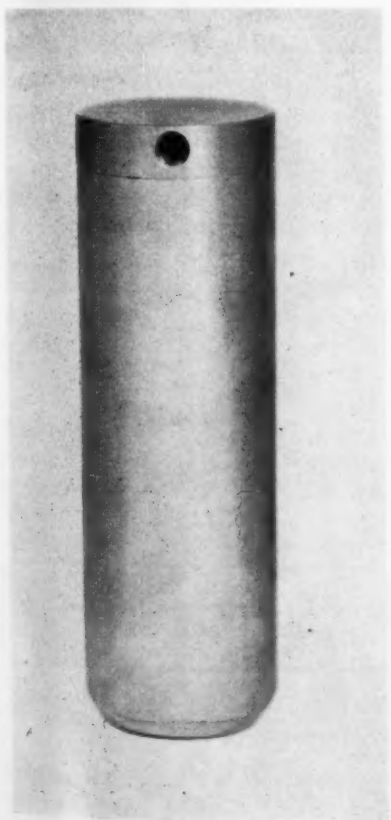
Natural rubber-coated gloves for women, lined with soft, napped fabric, are now available, according to the above firm, industrial glove manufacturers. The gloves, marketed under the trade name, "Swaggerette," can be used advantageously in many female occupations in industry, such as assembling or inspecting parts, handling rough, sharp, dirty, wet or harmful materials. Affording ideal protection against skin irritations, they appeal to

women workers because they are easy to put on and take off . . . are flexible and comfortable. "Swaggerettes" are gauntlet style gloves in pastel green color, and are available in three sizes—small, medium and large.

High Pressure Filter Units

Micro Metallic Corp., Dept. MF, 193 *Bradford Street, Brooklyn* 7, *N. Y.*

Filter assemblies introduced last December, equipped with porous stainless steel filter elements, and rated for 200 psi service, have brought numerous requests for units rated for higher working and differential pressures.



The above firm now offers high pressure units rated for service at 1,000 and 10,000 psi. Filter elements may be specified for use at differential pressures up to 10,000 psi. The very high flow capacities characteristic of the porous stainless steel filter material are retained in these units. Due to the high strength of the filter material, no change occurs in the filter even under stresses as high as five tons per square inch, it is claimed.

The filter containers are provided in carbon steel or in stainless construction. Filter elements are all stainless. Stainless containers are of sanitary construction, and in most cases are of the quick opening type.

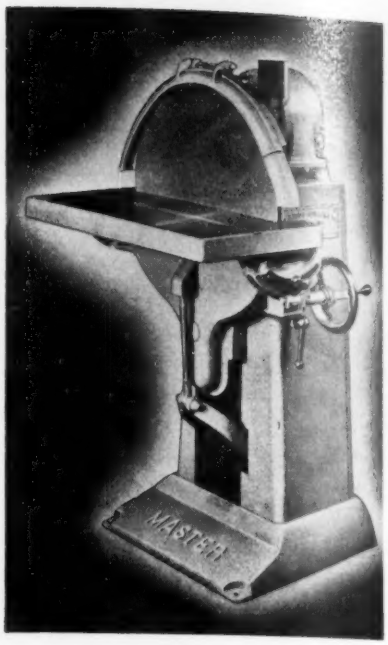
Typical applications are: In liquid air manufacture to remove small particles of graphite from graphite lubricated compressors; in rayon, for high pressure clarification, in hydraulic systems, to remove solids which might damage mechanical parts.

24" Disc Grinder

Kindt-Collins Co., Dept. MF, 12653 *Elmwood Ave., Cleveland* 11, *O.*

The above announces a new 24" Disc Grinder, said to have the most advanced design features in the industry. It is a versatile and rugged machine, designed for the efficient sanding or grinding of wood, metal and plaster.

This new grinder is made vibrationless through perfect balancing which permits extreme accuracy in grinding, it is claimed. It is quickly and easily adjusted by means of a counterbal-



anced table, which can be moved up or down 11" by hand pressure to any desired position.

A distinctive feature of the grinder is the reversible disc for right or left hand jobs. A 5" hole in the back of the machine permits attaching to a house suction system or dust collector.

New Drum Pump for Volatile Liquids

General Scientific Equipment Co., Dept. MF, 2700 W. Huntingdon St., Philadelphia 32, Pa.

This efficient, self-priming drum pump for alcohols, paint thinners, light oils and other volatile liquids is equipped with a positive shut-off valve that is absolute protection against evaporation losses. Its maximum capacity is 15 gallons per minute.

The No. 750 pump has no pistons, rings or leathers; no rotating parts to stick or wear. The special diaphragm is a heavy cord-fabric vulcanized between synthetics. It does not dry out, swell up, rust or corrode and is unaffected by petroleum products, alcohol and most other fluids, according to the manufacturer.

Business Items

Barney Hoffski Joins Michigan Buff Co.

Al Payson, of the *Michigan Buff Co.*, 3503 *Gaylord Ave., Detroit,*

Barney Hoffski

Mich., has announced that *Mr. Barney Hoffski* has joined the firm and is now in charge of the Buff and Polishing Wheel manufacturing departments. Mr. Hoffski was for many years in charge of similar operations for the *Udylite Corp.*, and brings to Michigan Buff Co. a wealth of knowledge and experience in the manufacture of quality products. He is widely known to the trade for his capabilities in producing the highest grade of polishing wheels.

Stevens Appoints New Cleveland Manager

Mr. A. H. Losey, who recently joined the *Frederic B. Stevens* organization, has been named manager of their Cleveland Office, in the *Fidelity Building*, 1940 *East Sixth Street, Cleveland, O.*

A. H. Losey

Mr. Losey has spent twenty-three years in the electroplating and metal finishing industry. He was formerly employed in a supervisory capacity by both the National Brass Company and Winters & Crampton of Grand Rapids, Mich. Later on, he joined forces with J. C. Miller Co. of Grand Rapids as Sales Engineer. From there, Mr. Losey went with the Hammond Machinery Builders of Kalamazoo, Mich.

Just prior to his affiliation with Stevens, he owned and operated the Kenart Manufacturing Co. in Kalamazoo, where he sold equipment and supplies, as well as conducting a job plating shop.

The industry in Cleveland and the immediate north central section of Ohio is fortunate in having a man of Mr. Losey's long and varied experience available for consultation on plating and finishing problems.

Conventioneers Combine Business With Pleasure at Atlantic City

Some of the boys who attended the recent AES Convention at Atlantic City decided to relieve the strains of fishing for knowledge by taking a crack at the real thing, for which the seaside resort is justly famous. Having hired a boat and loaded it down with all the essentials (?) for a successful day, the group shown in the photos proceeded to enjoy themselves even to the extent of catching some fish. A pool was arranged, with the total being split into two prizes. For catching the first fish, *Mr. Burkhardt*, of Westinghouse divided the pool with

Fig. 1—Left to right: Paul Glab, Northwestern Plating Co., Chicago; R. J. Christian, National Cash Register, Dayton; R. J. VanDeventer, National Cash Register, Dayton; Mr. Farber, Westinghouse Electric, Mansfield, Ohio; C. R. Crawford (back to camera), Chrome-Rite Corp., Chicago.

Fig. 2—Left to right: Mr. Parks, Westinghouse Electric, Mansfield, Ohio; Bill Neill, Columbus Metal Products, Columbus; John Daymude, Crosley Corp., Cincinnati; Mr. Burkhardt, Westinghouse Electric, Mansfield, Ohio; Harvie Johnson, Belke Mfg. Co., Chicago.

Mr. Daymude, of Crosley Radio, who caught the most and largest fish. The total catch was an assortment of groupers, sea bass, skates, and robins. All hands returned (which in itself is an accomplishment) with the feeling that conventions, especially in Atlantic City, are very educational. From the photos herewith, we gather that they stayed pretty close to shore. (Why is it that pictures of the group after their return to shore are usually omitted?)

Underdog Comes Out on Top

The American Public characteristically roots for the underdog. And when a nobody shoulders up above the level of the crowd, he usually has general acclaim for being an example of the American tradition. This is the land where everyone has that chance. A fanciful example of this which made news has just occurred at the *Magnus Chemical Company's* plant in *Garwood, N. J.*

A stray dog appeared out of nowhere, without credentials, references or pedigree—not even a college degree. He looked like a tramp. But in a short time by sheer innate character and personality he had won a place in the hearts of all the workers.

His newly-made friends washed him, and discovered he was black, white and tan. They fed him and discovered he was hollow. They bought him a fancy collar, and a dog tag, and discovered that he had pride and self-respect; his tail came up and his former furtive air became purposeful. It also soon became apparent that behind his gentle brown eyes, there clicked a clever little thinker.

There is an old saying that those who insist on getting the best, are the ones who do get it. The pup apparently figured this out. So, he was put on the payroll as Mr. Magnus. It was not long before his sound qualities had so impressed Management that he had worked up from assistant watchman to Honorary Vice-President.

"MR. MAGNUS" HONORARY VICE-PRES.

His rapid rise from fleas to riches was made the subject of an article in the "Magnus Monthly Review." The local papers reprinted, for its human interest value. Associated Press picked it up, and Mr. Magnus' business career was big news, and in the news-reel.

Telegrams and letters and phone calls came in from all over the country,—congratulations, offers, contracts. Mr. Magnus had to have his own secretary. He may now be seen only by appointment. Mr. Magnus came to town. Mr. Magnus made good.

"Still," Mr. Magnus said, delicately stifling a belch behind a well-manicured paw, "running a business today is really a dog's life."

Art Perkins New Eastern Representative for Hammond

To better serve their Eastern clients, *Hammond Mach'y Builders* of Kalamazoo, Mich., have appointed a new Eastern Representative, *Mr. Arthur L. Perkins, 5C River Park Apartments, White Plains, New York.*

Art has always lived in the East and is well and favorably known throughout the eastern seaboard metal finishing industry. His practical knowledge of metal finishing, technical background, and production experience will be helpful to users and prospective

Arthur L. Perkins

users of Hammond equipment. For the time being, he can be reached at his above home address. Later on, he will have a centrally located office.

West To Manage Industrial Sales for Honeywell Co.

Ray R. West has been named manager of sales of Minneapolis-Honeywell Regulator Company products for industrial applications.

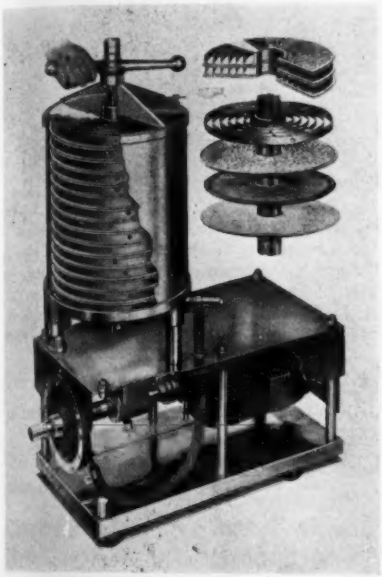
West's appointment, said *Brown Instrument Company* officials, is in line with current Honeywell sales expansion and new products developments for control of temperature, humidity and pressure in industrial and specialized fields. West, who has filled executive sales positions with Brown Instrument during his more than 20 years with the industrial division of Honeywell, will make his headquarters at the Brown plant in Philadelphia.

Ray R. West

Alsop Stresses Service to Customers

One of the important points of the *Alsop Mfg. Co.* sales program is the prompt service that they are always ready to render to their customers. This was demonstrated recently when a complete filter unit in need of repair was flown to the Alsop plant, repaired, and was back in operation in the customer's plant that same night.

The unit, similar to the type shown in the photo, was flown to Southington in the private plane of the *Ingraham Research Laboratories*, of East Stroudsburg, Pa., who were in urgent need of the unit in their daily work.



While this was an unusual case, the company is prepared to render immediate service and help to all of its many customers, according to officials of the firm.

R. O. Blackford New Advertising Manager for Michigan Abrasive

A man whose family boasts three generations of service in the abrasive field recently was named Advertising and Sales Promotion Manager of the *Michigan Abrasive Company*, of Detroit, Mich. He is *Robert O. (Bob) Blackford*.

Announcement of Mr. Blackford's appointment was made by *Max C. Jones*, Michigan Abrasive president.

Mr. Blackford comes to the Detroit Company after considerable service with another company in the coated abrasive field, following in the footsteps of his father and grandfather. Mr. Blackford's grandfather, *W. H. Beamer*, started in this industry in 1903 for the Herman Behr Co. of Brooklyn, fore-runner of the merged Behr-Manning Co., and was joined in 1922 by his father. Mr. Beamer retired in 1928 but Bob's father, *Charles O. Blackford*, still continues in this industry.

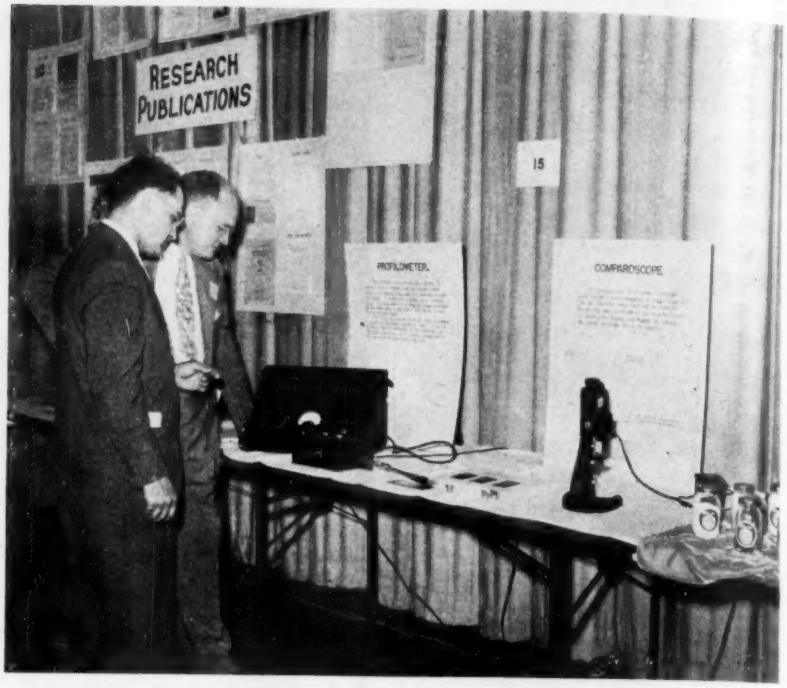
R. O. Blackford

Bob Blackford is a native of Grand Rapids where he was graduated from Ottawa Hills High School. He later attended Michigan State College.

Bob has served in sales correspondence and branch management capacities in Grand Rapids, Toledo, Cleveland and Detroit.

Although his work always has kept him very busy, Mr. Blackford finds time for his hobbies of wood working, fishing and golf.

Wyandotte Chemicals Research Staff Stages Seminar Meeting



Evans (Dutch) Schmeling, at right, assistant manager, Wyandotte Chemicals Industrial Department, inspects a display of instruments for measuring surface roughness at the third annual staff meeting of the Company's Research Department. At left is Andrew Liger, head of the Wyandotte Industrial Laboratories. The profilometer measures surface irregularities in terms of millionths of an inch. The comparascope permits visual comparison of two separately metal finished surfaces as though they were joined together.

The third annual staff meeting of the *Wyandotte Chemicals Corp. Research Department*, held at the Hotel Statler in Detroit on July 21, featured 19 exhibits depicting various phases of the activities of the organization and arranged in trade convention style. Featured speakers at the one day meeting were *E. M. Ford*, president of Wyandotte Chemicals; *W. F. Torrey*, senior vice president; *Ford Ballantyne, Jr.*, assistant vice president; and *Thomas H. Vaughn*, vice president—research. One session of the Seminar was devoted to reports by *S. T. Orr*, vice president in charge of production, and twelve production and engineering executives on their part in the nearly completed $30,000,000 W.C.C. Expansion Program, and how present and contemplated research projects would affect their future manufacturing procedures.

The display which attracted the greatest attention at the research meeting was equipment now being used in investigating the application of radioactive materials as "tracers" in detergency. These studies should result in improved products and advanced methods which in the future should be of value to all industries using commercial cleaning materials. Several displays showed equipment capable of measuring to a millionth part of an inch; of enlarging electronically and photographically 40,000 times; of electronically testing fabrics repeatedly without destroying or deforming the fibers. One exhibit featured the commercial application of a material which promotes synthetic detergents—giving them sufficient washing power to handle routine industrial cleaning jobs; thus for the first time commercially in America synthetic detergents, which formerly had limited application, are becoming available to many industries for innumerable uses.

E. M. Ford, president of Wyandotte Chemicals Corporation, told his dinner listeners: "Wyandotte Chemicals is always building—always expanding. In the seven years 1925 to 1932, we completed a building program that in the uninflated money of that day exceeded our recent expenditure. However, in our present program we expanded in two years to a greater degree than we formerly did in seven. As a result of the expansion program, Wyandotte Chemicals now has the most diversified production in its history."

Ed Clark Given Testimonial Dinner Upon Retirement

Mr. Edwin R. Clark, for the past 34 years Foreman Plater at the *Warren Webster & Co.,* plant at Camden, N. J., was feted at a testimonial dinner by the employees of the various departments of the firm on the occasion of his retirement from the company on July 30th. Mr. Clark was presented with a fishing pole, and Mrs. Clark was presented with a large bouquet of gladiolas by Mr. Webster. Eighty-three friends and fellow workers were present. Mr. Clark's period of employment with the firm was unique in that he had never been absent from work for sickness for 34 years. He began his plating career with the Clark Bros. Lamp Brass and Copper Co., Trenton, N. J., in 1900.

Mr. and Mrs. Clark have purchased a home at 1224 North H St., Lakeworth, Florida, where they plan to settle permanently.

Cowles Detergent Company Announces Change in Name

At a special meeting held in Cleveland, Ohio on August 16th, the stockholders of *The Cowles Detergent Company* approved a resolution changing the firm's name to *Cowles Chemical Company.*

Founded in 1885, the Company has long been active in the manufacture of industrial chemicals and detergent silicates as well as specialized detergents for the laundry and metal cleaning industries. A postwar innovation has been the Company's entry into the field of specially formulated cleaners and bactericides for the food processing industries. The change in the Company's name is indicative of its continued further expansion in the field of industrial chemicals.

No change in management or ownership of the Company is effected by the stockholders' action and no alteration of the Company's sales policies is anticipated.

Allied Research Appoints Sales Agents

Allied Research Products, Dept. MF, 4004 *E. Monument St., Baltimore, Md.*

The following agents have been appointed for the sale of Iridite, the corrosion resistant treatment for zinc and cadmium surfaces, according to a recent announcement by the above firm.

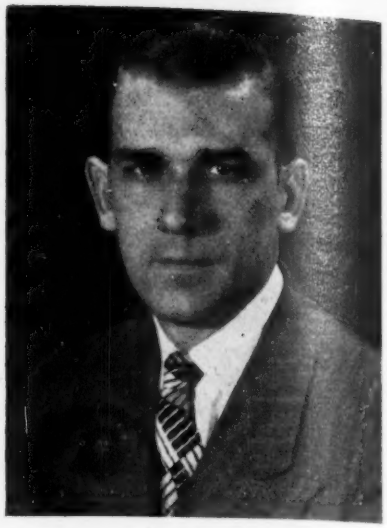
L. J. Camill, Detroit, Mich., to cover all of the state of Michigan; *J. A. Cairns,* Yeadon, Pa., to cover eastern Pennsylvania and New Jersey; *Industrial Chemical and Equipment Co.,* Minneapolis, to cover western Wisconsin and Minnesota; *LaSalco, Inc.,* St. Louis to cover the central Southwest; *C. H. Hohner,* Atlanta, to cover the southeast states; *Mitchell-Bradford Co., Bridgeport, Conn.* continues coverage of New York and New England; *A. L. Poe,* Chicago continues as District Sales Manager for Chicago and the central states.

Ray Stricklen has joined the company's Baltimore plant as Assistant Development Engineer.

New Western Editor for *Metal Finishing*

Finishing Publications, Inc., publishers of the monthly magazines METAL FINISHING and ORGANIC FINISHING announce the appointment of *Mr. Ferdinand C. Wehrman* as Western Editor and Chicago Manager, with offices at 612 *N. Michigan Ave., Chicago* 11, *Ill.* Mr. Wehrman will keep in touch with developments in the finishing field in the Mid-West, which is rapidly developing into the plating and finishing center of the nation.

Mr. Wehrman joined Finishing Publications as Assistant Editor of Metal Finishing in May, 1947, and later became Engineering Editor of Organic Finishing when that publication be-



Ferdinand C. Wehrman

came a separate monthly magazine. He also compiled and edited the Organic Finishing Guidebook-Directory, which is the first manual of its kind of practical information on industrial painting, lacquering and allied subjects.

A graduate of Fordham University, Mr. Wehrman was a Captain in the Chemical Warfare Section of the Army, and prior to his coming with Finishing Publications was Assistant Chief Chemist of the Castor Oil Products Co., Yonkers, N. Y. He is a member of the American Electroplaters Society.

Alpat Supply Corp. Enters Plating and Finishing Supply Field

The *Alpat Supply Corp.*, 155 *Chrystie St., New York* 2, *N. Y.* has been organized by *Mr. Pat Cordileon*, and will specialize in a general line of supplies and equipment for the plating, buffing, and polishing trades, including buffs, polishing wheels, wheel cements, used buffs, abrasive grains, etc. Mr. Cordileon has been connected with the polishing trade for 17 years, and was connected with the Wright Aeronautical Corp. during the last war. His intimate knowledge of the field will enable him to render expert service and advice to the trade. The firm will represent several leading manufacturers of plating and polishing equipment and supplies. The representative in New Jersey will be "*Duke*" *Dinallo*.

Nichols Elected Board Chairman of Mathieson Chemical Corp.

The Board of Directors of *Mathieson Chemical Corporation* has elected

Thomas S. Nichols

Thomas S. Nichols, president and chief executive officer, to the additional post of chairman of the board to succeed the late *George W. Dolan*. *J. C. Leppart*, vice president, was elected a member of the board to fill the vacancy caused by Mr. Dolan's death, and was appointed executive vice president.

Mr. Nichols was named president of Mathieson in April of this year. Prior to that, he was actively engaged in various phases of the chemical industry, having served the government during the war in several capacities in this country and Europe. He completed his service with the government as a member of the Technical-Industrial Disarmament Committee on Chemicals.

Mr. Leppart also joined Mathieson in April. During the war, he was with the War Production Board, devoting his efforts to alkalies, chlorine and related products.

Forsberg Heads Industrial Corrosion Control, Inc.

Industrial Corrosion Control Inc., Neville Island, Pittsburg 25, Pa., whose chief service is lining industrial equipment with anti-corrosive coatings, has been recently incorporated under the direction of *R. G. Forsberg*, president. Mr. Forsberg was formerly associated with Jessop Steel Co. as purchasing agent, and Timken Roller Bearing Co.

General sales offices for the firm will be maintained at the Empire Bldg., Pittsburgh, Pa. with *James D. Clokey, Jr.*, as Sales Manager. Clokey was formerly general manager of sales for Washington Steel Corp., Washington, Pa., stainless steel specialist for Su-

perior Steel Corp., Carnegie, Pa. and also associated with Carnegie Illinois Steel Corp. Sales representatives are located throughout the principal cities of the United States.

The plant, located at Neville Island, Pittsburgh, maintains complete facilities to line industrial equipment with Vinyl Plastisol, a thermo setting plastic which has proven highly successful as a protective agent against corrosion in industry.

NEW BOOKS

An Introduction to Metallic Corrosion

By Ulick R. Evans. Pub. by Longmans Green and Co., 55 Fifth Ave., N. Y. Price $3.25.

This book, written primarily to be used as a text in the teaching of the principles of corrosion and its prevention, explains the basic fundamentals underlying corrosion of metals and alloys, and means which can be used to overcome these destructive forces. The influence of environment, stress and strain, and structure on corrosion is pointed out, as well as the principles of inhibition by soluble materials. Corrosion by total and partial immersion, electrochemical corrosion of dissimilar metals, and corrosion without the influence of applied E.M.F. are all discussed in an informative and easily understood manner. The book fills a definite need in developing a basic approach to this subject of infinite complications and exceptions to the general rules, and will be welcomed by students and specialists alike.

W. A. R.

The Plating of Zinc Alloy Die Castings

Published by the ZADCA, London. Obtainable from *Finishing Publications, 11 W. 42nd St., N. Y. C. Price* $2.25 (*Incl. service and postage*).

This book, devoted exclusively to the plating and finishing of zinc base die castings, is a compilation of the latest practice in this country and abroad by recognized experts in each line. Emphasis is placed on considerations during the designing stages of the castings that will affect finishing and plating costs. A very comprehensive chapter

on Bright Nickel solutions is given, including data on the effects of impurities and methods for their removal. Cleaning cycles for the various plated finishes are discussed with relation to their effects on adhesion of the deposits.

This volume fills a long felt need for a text on this important subject, and will make a valuable addition to the library of every finishing man who is engaged in the plating of die casting alloys.

Modern Plastics Encyclopedia

Published by the Plastics Catalogue Corp., 122 E. 42nd St., N. Y. C. Price $8.50.

This 1700-page reference book on plastics is the largest and most complete compilation of technical and commercial information on plastics ever published. Every commercial plastic material and processing method is described in detail, and the amount and quality of the illustrations is exceptional. This year's edition incorporates a new section on plastic films and sheeting, as well as a listing of over 2000 Stock Mold items, including colors and materials in which these stock parts are available. New sections are also included on hydroxyethyl cellulose, inorganic plastics, pulp molding, and equipment for laminating and resin plants.

The new arrangement of the book, wherein all advertising is placed in separate sections adjacent to the technical material, will be welcomed by most users. The usual outstanding quality of binding and printing is maintained as in past volumes of this valuable reference.

W. A. R.

Chemical and Electroplated Finishes

By *H. Silman, B.Sc., F.R.I.C., A.M.I. Chem., E.* Published by Chapman & Hall Ltd., 37 Essex St., London W.C.2, Eng. Price $6.00 (30 shillings)

One of the best references on surface finishes for metals to be published in many years, this book is intended primarily for the engineer who must ordinarily plough his way through a mountain of details in deciding what finishes are most suitable for his products. This does not mean that the subject has been treated superficially. On the contrary, the material is unusually complete for a single volume on

this broad field, but the author brings out the important advantages and faults of the various finishes in such a way as to make the task of proper selection much simpler. Starting with a discussion of corrosion and its causes and control, the book describes in detail the various operations required to produce a commercially acceptable finish on different base metals, including the protective value of each type of finish. In addition to the usual plated finishes, most of the nonplated surface finishes and coatings are discussed including many proprietary processes and finishes.

While American engineers will find an occasional bit of information that would be contrary to the best practices in use in this country, the information is for the most part reliable and accurate, and the book will go a long way toward simplifying a subject that most engineers are accustomed to avoiding whenever possible.

F. C. W.

Manufacturers' Literature

New Roto-Finish Manual

The Sturgis Products Co., Dept. MF, Sturgis, Michigan.

A new manual illustrating and describing Roto-Finish mechanical deburring and finishing has been published by the above firm.

This 16-page, two color, 8½" x 11" booklet is the first complete and authentic description to be printed on Roto-Finish, the original Mechanical Finishing and Deburring method. The use of the Roto-Finish method is examined in detail with complete coverage of the four principle procedures which make up the process—Deburring and Grinding, Polishing, Britehoning and Coloring.

In addition, the new booklet tells step by step how Roto-Finish operates; the types of parts to which it is best applied; the formulas that govern the mixtures of chips and compounds. It lists the considerations to be made in selecting equipment best adapted for various applications. It also offers engineering advice on parts design to gain the greatest economies by Roto-Finishing.

Copies of the new booklet may be obtained without charge by writing on company letterhead to the above address.

Salt Spray Testing Machines

Belke Manufacturing Co., Dept. MF, 947 N. Cicero Ave., Chicago 51, Ill.

Describes in detail Belke Salt Spray Machines for Salt Spray and other tests to determine the corrosion resistance of bare metal, and the effectiveness of protective coatings such as anodized, electro plated or galvanized coatings, paints, rust preventatives, etc.

Belke Salt Spray Machines conform with Government Specifications for Salt Spray Testing Equipment as covered in Federal Standard Stock Catalog QQ-M-151a (March, 1945).

New Bulletin on Plating Racks

The Standard Plating Rack Co., Dept. MF, 1913-25 *N. Paulina St., Chicago, Ill.,* has issued a twelve page bulletin of plating rack parts, accessories, tools, materials, tips, insulation and repair equipment. The bulletin describes the uses of the various parts and components. The technique of rack manufacture is set forth in a clear and concise manner. Every item necessary to make a rack is listed. Write for your copy.

Selenium Rectifiers

Vickers Electric Div., Dept. MF, 2160 *E. Imperial Highway, El Segundo, Calif.*

This firm has just issued a booklet describing the series of selenium rectifiers and rectifier stacks manufactured by them. The characteristics, applications, and design factors are discussed in graphical form. Tables list the various sizes and capacities available, and price lists are also included.

Copies of this booklet are available by writing on company letterhead to the above address.

Exhaust Fans and Blowers

General Blower Co., Dept. MF, Morton Grove, Ill.

A new bulletin just issued by this firm describes a line of blowers, fans, and exhaust equipment for every industrial and heavy duty application. Both high speed and low speed models are available in a large variety of sizes. Typical applications for which these fans are designed include polishing and buffing exhaust, welding fume dispersal, spray booths, and the removal of hot and corrosive gases from industrial processes. Included also in this booklet is a section on Roof ventilators and window-mounting fans.

Handbook on Industrial Instrumentation

Brown Inst. Co., Dept. MF, Phila. 44, Pa.

To keep pace with the tremendously accelerated interest in instrumentation and automatic control and to augment information published in the technical and trade periodicals, the Brown Technical Section has undertaken the preparation of a perpetuating looseleaf Handbook of Industrial Instrumentation.

Hundreds of industrial instrument applications will be taken up—one at a time. Each application will be described on a separate sheet or two-page folder, depending upon the scope of the subject. These sheets or folders, identified as Instrumentation Data, will be coded according to the U. S. Government Classification of Industries and will be punched for convenient notebook filing. The sheets will be prepared by engineers in a strictly engineering fashion and will be devoid of the commercialism often prevalent in catalogs and company-published brochures. Copies may be obtained by writing to the above address.

Metal Cleaning Detergents

Technic, Inc., Dept. MF, 39 Snow St., Providence, R. I.

A new bulletin just issued by this firm describes their two synthetic detergents for metal cleaning prior to plating. Prices and characteristics of these "Determined Detergents" are given. Used in the proportion of 1-2 oz/gal., these materials are claimed to offer outstanding advantages together with lower costs in the removal of rouge, buffing compounds, glue, oils, greases, etc.

Protection for Industrial Workers

Dunn Products, Dept. MF, 1214-1222 W. Madison St., Chicago, Ill.

Catalog No. 11 describes a complete line of protective clothing and other devices for industrial workers. Gloves, aprons, jackets, overalls, leggings, and boots, in several materials including rubber and canvas are explained, as well as finger guards, foot guards, safety gogles and acid handling pitchers and funnels. Also included is data on the selection and care of rubber gloves.

Bulletin on Chrome Plating

Chromium Corp. of America, Dept. MF, 120 Broadway, New York 5, N. Y.

A new bulletin just published by the above firm describes in detail the Crodon method for chrome plating. The bulletin is well illustrated with typical applications showing how the method has solved difficult problems in industry on both small and large parts. Parts as long as 20 feet have been successfully plated, and diameters up to 12 ft. Relative costs and properties are given in convenient charts and graphs.

Corrosion Resistant Coating for Wood Tanks and Floors

Carboline Co., Dept. MF, 502 N. Taylor, St. Louis 8, Mo.

The above firm has announced a new type of chemical resistant coating for wooden structures such as tanks, floors, fume ducts, and table tops. Applied by brushing, the following claims are made for this material:

1) Coating cannot be separated from the wood.
2) Impervious to boiling water indefinitely.
3) Resists acids, alkalies, and solvents. Chief exception is nitric acid and sulfuric acid over 45% concentration.
4) Presents hard surface, easy to keep clean.
5) Film is somewhat flexible, up to about 15%.
6) Sets by polymerization—no evaporation of solvent or oxidation are involved.
7) Resists temperatures up to 325°F.

Literature further describing typical applications and possible uses for this material will be forwarded upon request. Ask for Bulletin M-2.

Seeing Is Deceiving . . .

Those who missed the intriguing display of optical illusions at the International Nickel Company Booth during the recent Atlantic City Convention of the American Electroplaters' Society are invited to get in on the fun by writing for their free copy of "SEEING IS DECEIVING." This entertaining and instructive booklet was designed to demonstrate that appearances can be deceiving and that quality plating depends on tests. Booklets are available from *International Nickel Company, 67 Wall Street, New York 5, N. Y.*

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY
Los Angeles Branch

With monthly business and educational sessions off the schedule during July and August, some 200 members, their families and friends of Los Angeles Branch took advantage of a mid-summer get-to-gether by attending the annual branch picnic in LaDera Park, Inglewood, Calif., on Sunday, August 1.

This mid-summer gathering of the finishing and plating clan of Southern California was an anuual affair until it was interrupted by the war in 1942. It was resumed last year with such gratifying attendance that it was again

scheduled this year. Arrangements were handled by a committee headed by *Stanley Rynkofs* as chairman, and *Howard Woodward* as co-chairman.

The athletically inclined stalwarts among the younger members took part in a baseball game in which the *Platers* were aligned against a team composed of supply house technicians and representatives. These teams were managed respectively by *Stanley Rynkofs* of the Liberty Plating Co. and *Howard Woodward* of the Sundmark Supply Co. Both gentlemen demonstrated their versatility by also playing on their respective teams. Stanley served as the brawny-armed pitcher for the *Platers* and held the *Suppliers* to 15 hits and 7 legally counted runs. Howard initiated a "New Look" in baseball by playing third base in a black derby hat. All efforts of opposing batsmen to aim their line drives at Howard's derby failed, when he nonchallantly stepped aside whenever a drive came within 10 feet of him.

In a game in which the rules and regulations of the National game were blithely ignored when the occasion warranted it, the *Platers* scuttled the *Suppliers* by a score of 13 to 7. Contributing materially to the minority seven scored by the *Suppliers* with hefty hits in time of need were *John Millhorn* of *Mefford Chemical Co.*, *Frank Bunker* and *Dean Williams of L. H. Butcher Co.*, and *R. J. Wooley* of *United Chromium*. Leading the attack which sunk the *Suppliers* were Platers *Ray Vasquez*, *Jean* and *Stanley Rynkofs*, and a number of others whom the illegible handwriting of the official scorekeeper has blanketed in anonymity.

The umpiring of *Don Bedwell*, superintendent of the *Hallenscheid-MacDonald Co.*, was of such superior quality that he was threatened with mayhem only nine times in the seven inning ball game.

Family picnic dinners were enjoyed at noon, with the Picnic Committee serving free soft drinks and ice cream with the compliments of the association. Frank Bunker, and Stanley Rynkofs presided over a series of races and contests which were staged for the benefit of the children.

A goodly representation of members who do not have an opportunity to attend all the branch meetings made an appearance at the picnic. The group was pleased to have among them the branch's only two Honorary Life Members of the Supreme Society: *Ernest Lamoreaux*, and *Frank Rushton*, who drove over from Sawtelle Military Hospital with a friend to talk a bit of shop. Also seen diligently belaboring chicken wings were such well known figures as *Marcus Rynkofs*, *Joseph Sunderhaus*, *Emmette R. Holman*, *Earl Coffin*, *John Merigold*, *Ernest Francis* and many others.

Los Angeles Branch will resume regular monthly meetings on September 8th, for which Librarian *Ed George* of the *Ace Plating Co.* has promised a top speaker to initiate the Fall series of meetings.

AMERICAN SOCIETY FOR METALS

The 30th Annual National Metal Congress and Exposition will be held in Philadelphia's Commercial Museum and Convention Halls for five days beginning Monday, October 25th.

Meeting simultaneously with the

American Society for Metals will be the *American Welding Society*, the *Institute of Metals Division* of the *American Institute of Mining and Metallurgical Engineers* and the *Society for Non-Destructive Testing* (formerly the American Industrial Radium and X-Ray Society). These societies will conduct technical programs relating to the science of metals during the week of October 25th.

The 1948 Metal Congress and Exposition marks the fourth time that the event has been held in Philadelphia. Previous Expositions were held there in 1920, 1928 and 1941.

Technical programs of the four societies will be announced at a later date.

Willard H. Dow to Receive Medal

The American Society for Metals today announced that *Willard H. Dow* has been elected to receive the Society's Medal for the Advancement of Research for 1948. Dr. Dow is president of the *Dow Chemical Company, Midland, Michigan.*

The medal, awarded first to *Roy A. Hunt*, president of the Aluminum Company of America, in 1943, has been won in succeeding years by *Robert C. Stanley*, president of the International Nickel Company; *Gerard Swope* of the General Electric Company; *Dr. Rufus E. Zimmerman*, vice president, U. S. Steel; and in 1947 by *Charles R. Hook*, president of the Armco Corporation, Middletown, Ohio.

Presentation of the medal, plaque and citation will be made at the annual banquet of the American Society for Metals to be held in Philadelphia on October 28th during the National Metal Congress and Exposition.

Dr. Dow was born in Midland, Michigan. He began his career with the Dow Chemical Company upon his graduation from the University of Michigan where he received his B.S. in Chemical Engineering.

In addition to his degree in science from Michigan, Dr. Dow also holds an honorary degree of Doctor of Engineering from the same University; D.Sc. from Michigan College of Mining and Technology, and Doctor of Engineering, Illinois Institute of Technology.

At Dow Chemical the Research Medalist has served as Chemical Engineer, Assistant General Manager, General Manager, President and Chairman of the Board. Since 1947 Dr. Dow has served as both President and Chairman of the Board.

National Safety Congress

The 36th National Safety Congress and Exposition, sponsored by the National Safety Council, will be held in Chicago from October 18 through October 22, 1948. Five leading hotels will house the safety sessions and expositions. They are: *Stevens Hotel*, for the industrial safety exposition and industrial sessions; *Sherman Hotel*, for the public safety exposition and traffic, farm, home and women's safety sessions; *Morrison Hotel*, for industrial and school and college sessions, and *Congress* and *La Salle Hotels*, for industrial sessions. For further information, write to *George E. Burns, National Safety Council, 20 N. Wacker Drive, Chicago 6, Ill.*

Courses in Electroplating

Institute of Electrochemistry and Metallurgy

The Institute of Electrochemistry and Metallurgy, 59-61 *East Fourth Street, New York City*, will offer specialized courses in the field of electroplating and metallurgy during 1948-49. Advancements made in the metal finishing field during the war years are covered. Veterans can attend the School under the G.I. Bill of Rights. Registration for the Fall term will be held from September 13 to September 17 and the first class will meet on September 21. The following studies will be offered.

FALL COURSES

ELECTROPLATING I.

The course is designed to give the electroplater or industrial worker a foundation in chemistry including qualitative and quantitative analyses. One hour each evening will be devoted to class lectures in which will be discussed the theories of modern chemistry as applied to electroplating. The remaining hours will be devoted to the laboratory where the student will conduct his own experiments. Tuesday and Wednesday from 7:30 to 11:00 P. M. *Dr. Young, Mr. Klinse* and *Mr. Bundy*. Fee $56.00.

METALLURGY I.

The student will be introduced to the structure of metals and alloys and factors are taken into account which affect these, such as temperature, mechanical working, etc. The application of the phase rule to physical metallurgy will be discussed. Both binary and tertiary systems will be studied and illustrated. Heat treating, surface treating and testing of metals and alloys will be studied. Tuesday and Wednesday 8:30-9:30 P. M. *Dr. Young, Mr. Klinse* and *Mr. Bundy*. Fee $41.00.

RESEARCH I.

This course is designed to give the practical electrochemist a chance to investigate problems in his field. One half hour per week is devoted to a conference with the instructor in which the method of attack is laid out. The remaining time is spent in the laboratory where the student applies his knowledge and technique to the solving of problems which arise in such an investigation. Tuesday and Wednesday, 7:00-11:00 P. M. *Dr. Young, Mr. Klinse*, and *Mr. Bundy*. Fee $41.00.

Time payments may be arranged if desired. For further information call OREgon 3-6256.

Correspondence Course in Practical Electroplating

Joseph B. Kushner, Metal Finishing Engineer, of New York and Stroudsburg, Pa., announces the inauguration of a new correspondence course for practical electroplaters, called "Electroplating-Know-How." The course will be personally conducted by Mr. Kushner, by mail, from his laboratory in Stroudsburg. The course has been designed to give electroplaters a solid background in the basic fundamentals of plating so that they can carry on their plating operations from a more modern and scientific point of view and advance themselves in their work. Along with the "know-how" of plating, it gives the "why-how" in simple, easy-to-understand language and experiments that teach a man to think plating. Inquiries for further information on the course may be made in writing directly to *Joseph B. Kushner, Metal Finishing Engineer, Stroudsburg, Pa.*

News from California

The Menasco Mfg. Co., Burbank, Calif., is readying its huge wartime plating plant and retooling for participation in the new armament program for the making of plane struts for Lockheed Aircraft Co.

Equipment in the Menasco plating division has been under canvas on a standy-by basis since the close of the war. It is one of the finest equipped finishing shops in the West. Facilities include 36,000 ampere rectifier capacity and 5,000 ampere generator capacity, as well as complete setups for Cadmium, Zinc and Hard Chrome plating. Tank equipment includes four 3′ x 7′ x 12′ units plus a large number of smaller ones.

The latest of eight expansion programs undertaken by the *Friden Calculating Machine Co.*, at *San Leandro, Calif.*, was recently completed at a cost of approximately $1,000,000. It included the erection of three new steel structures plus expansion of existing factory buildings for the manufacture and assembly of calculator parts. The company's metal finishing department is one of the finest on the Pacific Coast. Facilities are on hand for applying a score or more of different finishes in the plating department, ranging from a full-automatic Udylite plating setup for Cadmium, and equipment for Copper, Nickel and Chrome plating, black oxide work, Bonderizing, and a number of other processes required in finishing the numerous parts in the all-metal Friden calculator.

The *Small Industries of Northern California, Inc.*, was recently organized as a trade association with membership composed of operators of stamping, plastic moulding, die-casting, sand blasting, forging, industrial metal finishing, welding and sheet metal plants. *Don Sigerson* president of *All Work Mfg. Co., Oakland*, has been named president. Other officers are: *George Smedborg, Associated Lighting Service, San Francisco*, vice-president; and *Kyle Van Nest, Precision Machine Products Co., Alameda*, secretary-treasurer. An advisory committee has been named, composed of representatives of Bay Area chambers of commerce, banking and industrial interests. Headquarters of the association have been established in Oakland.

The *Associated Manufacturers of Southern California* have announced plans for establishing at Los Angeles a permanent exhibit of the facilities of local metals, plastic and wood manufacturers and processors. The exhibit is to be laid out to stimulate trade with Southern California manufacturers and to bring recognition to that area's industries.

Obituary

George W. Dolan, chairman of the board of directors of *Mathieson Chemical Corporation* (formerly The Mathieson Alkali Works) died on July 24 after a brief illness. He was 46 years old.

Mr. Dolan was born in Cleveland, Ohio, and attended grammar and high schools in that city. He was graduated from Western Reserve University at Cleveland in 1928.

George W. Dolan

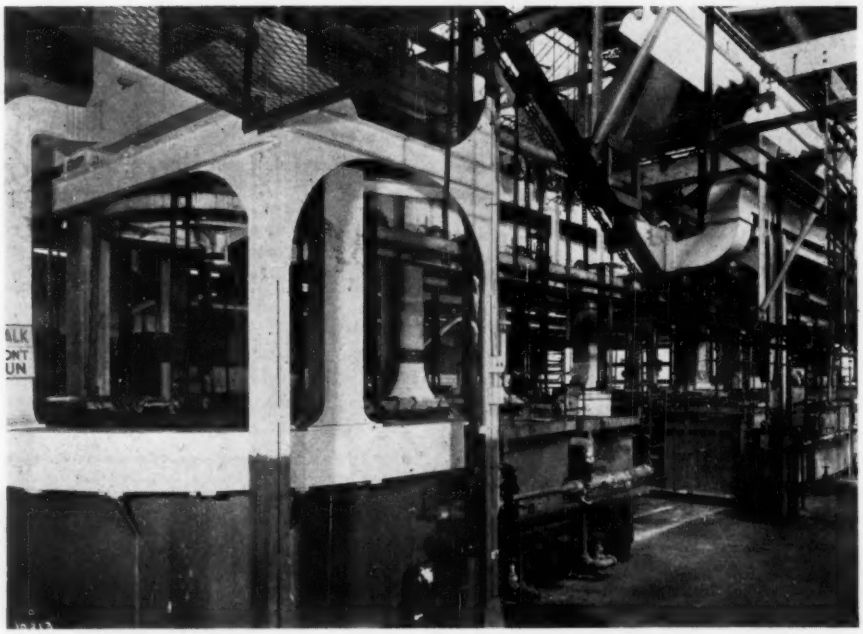
After joining Mathieson as a salesman in 1930, Mr. Dolan became manager of corbon dioxide sales in the following year and in 1935 was made assistant general manager of sales. He became assistant to the president of the firm in 1937, and the following year was named vice president. In 1940 Mr. Dolan was chosen executive vice president and on January 1, 1944, became president of the company. In April, 1948, he was named chairman of the board.

A veteran of World War I, Mr. Dolan was active in the American Legion. During the last war he was Assistant District Chief of the Chemical Warfare Service of the U. S. Army's New York Procurement District.

JUST RELEASED BY PRIVATE PLANT

VERY MODERN LATE TYPE
Finishing and Stamping Equipment

PRICED FOR QUICK SALE!



MEAKER AUTOMATIC ZINC PLATING and BONDERIZING MACHINE: NEW IN 1946

Conveyor type; Transfer chains, carriers, steel tanks, copper anode and busbars; All heating tanks equipped with steam heating coils. (Full data available.)

GENERATORS and RECTIFIERS

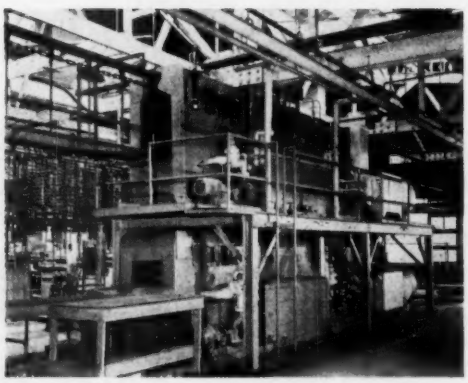
5000 AMP CHANDEYSSON GENERATOR: 6 volt; Type MP20; Synchronous motor drive; NEW 1945

2500 AMP RELIANCE GENERATOR: 6 and 12 volt; Synchronous motor drive; NEW 1942

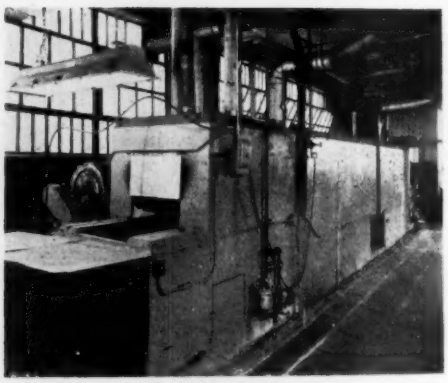
1500 AMP RELIANCE GENERATOR: 6 and 12 volt; 15 HP Ideal motor.

1500 AMP RICHARDSON ALLEN RECTIFIERS: (2) 3 phase 60 cycle 440 volt input; 9 volt 1500 AMP output.

2500 AMP 8 volt GREEN RECTIFIERS: (2) 3 phase 60 cycle 220/440 volt input.



INTERNATIONAL HYDROFLOW BELT TYPE WASHING MACHINES: (2); NEW IN 1945



DETREX DEGREASING and WASHING MACHINE: NEW IN 1945

PRESSES and SHEARS

NO. 3 LOSHBAUGH JORDAN OBI PRESSES: M.D. LATE TYPE (12)

NO. 4½ LOSHBAUGH JORDAN OBI PRESSES: M.D. LATE TYPE (3)

NO. S3120 PEXTO 10' 10 Ga. Cap. POWER SQUARE SHEAR: M.D. NEW IN 1941

POLISHING EQUIPMENT

7½ HP HAMMOND MODEL 7VRO VARIABLE SPEED POLISHING LATHES: (10)

5 HP L'HOMMEDIEU VARIABLE SPEED POLISHING LATHES: (3)

NO. 20 L'HOMMEDIEU 5 HP POLISHING LATHES: (2)

ROTO FINISHING MACHINE

INTERSTATE *Machinery Co., Inc.*

PHONE YARDS 5800

1448 W. PERSHING RD., CHICAGO 9, ILL.